TECHNOLOGY DEPT

War-Time Maintenance Number

OCTOBER 1942

COAL AGE

McGRAW-HILL PUBLISHING COMPANY, INC.

Price 35 Cents

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TRUCKS, DRILLS AND PUMPS
•
COAL-PREPARATION FACILITIES
•
Complete Table Contents, P. 5

Wear Raids ON BEARINGS STOPPED

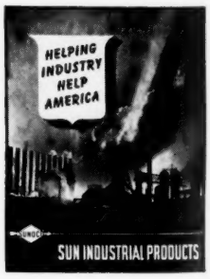
SUN MINE LUBRICANTS

stayed on the job twice as long . . . reduced wear

Vital to victory . . . that's what coal production is today! And in one of Pennsylvania's largest collieries faulty lubrication was putting a drag on production. Grease hardened after only 5 or 6 weeks' use . . . failed to reach the back of bearings, causing excessive wear . . . and men complained of cars being hard to push.

Then a Sun Oil Engineer — one of those capable Doctors of Industry — recommended Sun No. 300 Mine Car Grease. That solved the problem in double-quick time. No more wear raids . . . fewer bearing changes necessary . . . bearings always adequately lubricated when grease is applied only every 12 weeks . . . and cars are much easier to push.

Another contribution by Sun Engineers and Sun Mine Lubricants to the smashing victory America is winning on the production front. In your mine let Sun's Doctors of Industry help you. They stand ready, willing and able to help step up production and keep it up. For helpful examples of what they can do, write for "Helping Industry Help America."



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Sun Oil Company, Ltd., Toronto

LET'S GO! U.S.A. KEEP 'EM FLYING!

SUN MINE LUBRICANTS
include:
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SUN Compressor Oils
SUN Journal Oils
SUN Mine Car Lubricants
SUN Ball & Roller Bearing Greases

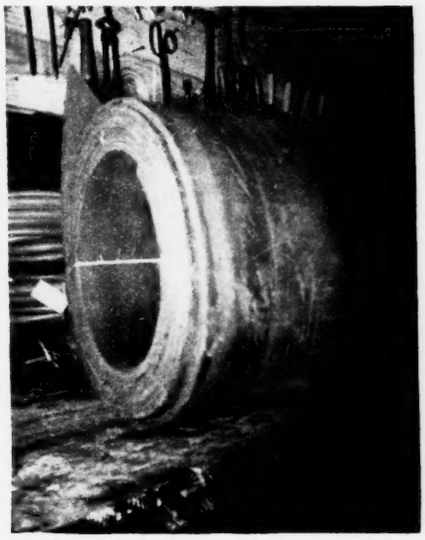
SUNOCO

SUN PETROLEUM PRODUCTS

HELPING INDUSTRY HELP AMERI

Old rubber belts made into new

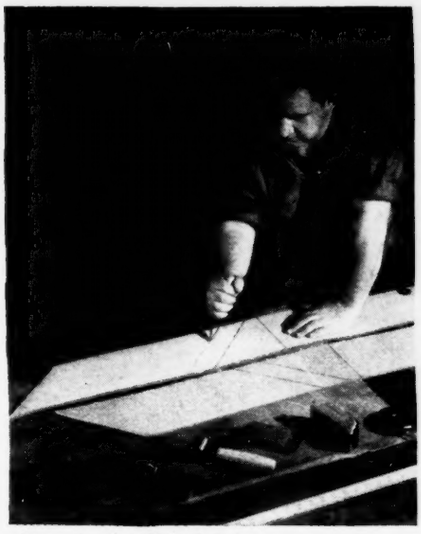
Save rubber — save money; don't throw away any rubber transmission or conveyor belting until you investigate



Worn belt ready to junk. Don't do it!

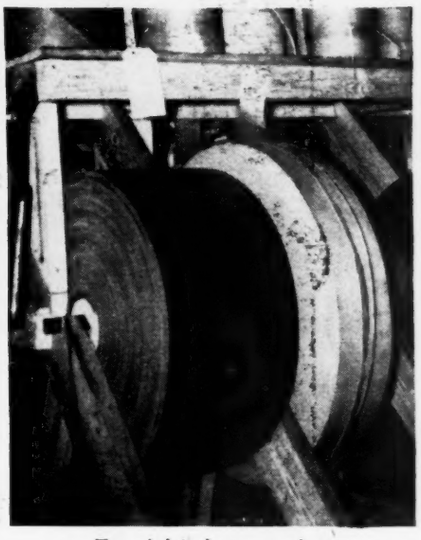
Slitting old belt into 2 narrower belts.

Ripping off worn pulley ply.



Preparing for Plylock Splice. Damaged spots can be patched, ready for vulcanizing.

Vulcanizing repairs or making belts endless by Plylock method.



Two belts almost good as new — for a few dollars.

Another B. F. Goodrich suggestion to save rubber

IT'S as easy and simple as that! B. F. Goodrich distributors are helping to conserve vital rubber by making new belts from old. If edges are worn, they are trimmed, and the old belt slit into two or more narrower widths for other drives. If top or bottom is worn, it is peeled off to the good plies underneath. If it is a conveyor belt and original width must be maintained, cuts and tears on the edges can be repaired.

Then vulcanized repairs are made and the new belts may be made endless (on the drive itself if you wish) by the Plylock Splice. A vulcanized repair is a *permanent* repair. It will last as long as the belt.

In this way months and even years of service are being saved from belts that had been headed for the junk pile. If you have any old, worn belts in your plant, call in your B. F. Goodrich distributor or write us for full details. Also write us for free copies of a series of folders on how to conserve all industrial rubber products you use; if you use conveyor belts we will also send you a Belt Maintenance Manual full of helpful information on making conveyor belts last longer. *The B. F. Goodrich Company, Industrial Products Division, Akron, Ohio.*

B.F. Goodrich

FIRST IN RUBBER

THE RIGHT GUARD

The man totin' the ball can't go it alone, and neither can your coal mine equipment without the *right* type of guard against friction. It takes a specialist to run interference and it takes a special quality grease to protect your equipment from opposing friction. Hulburt Quality Grease is the only grease made exclusively for coal mine equipment. Call in a Hulburt Specialist for your down-in-the-mine survey today.

HULBURT OIL & GREASE COMPANY

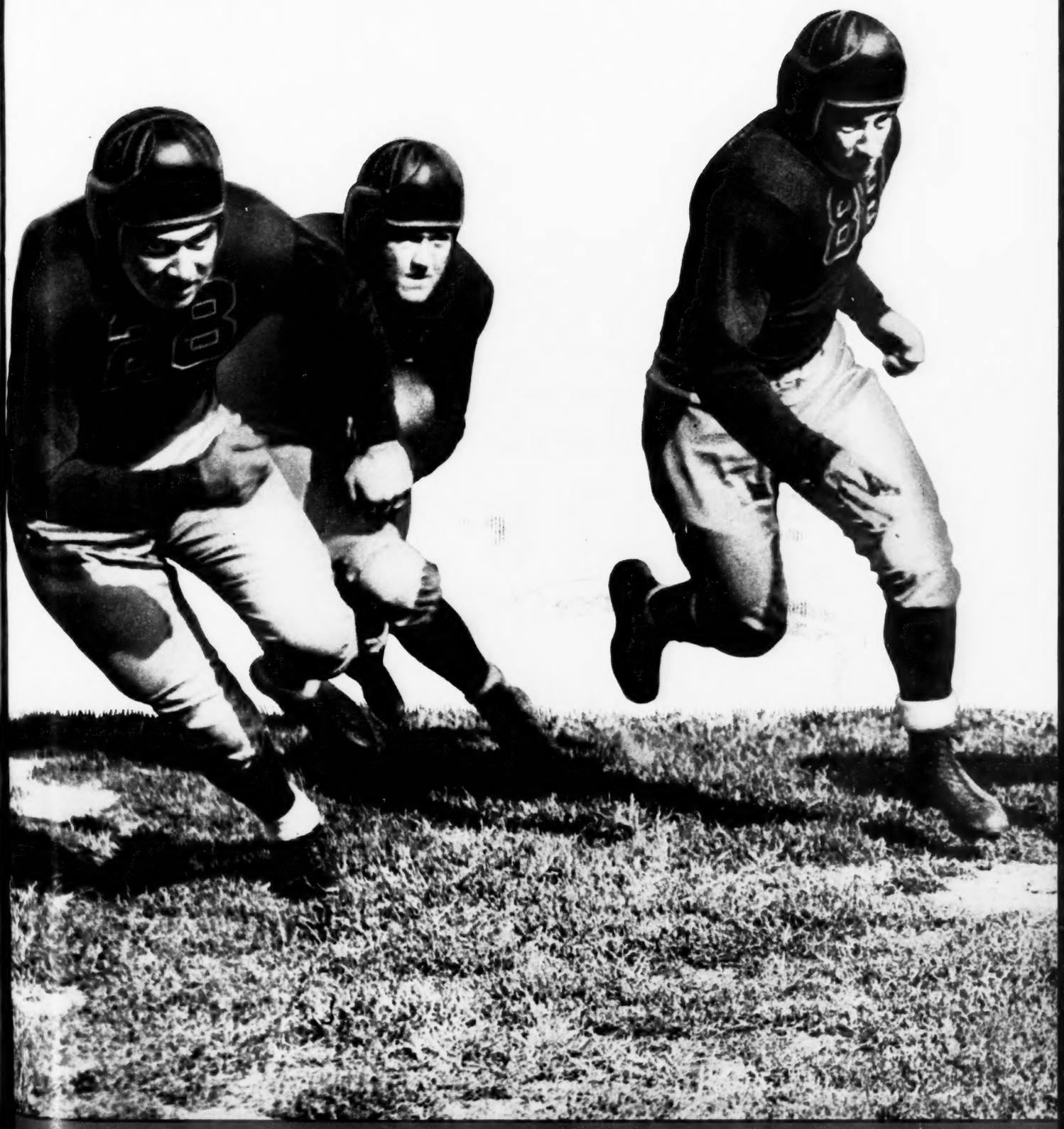
Specialists in Coal Mine Lubrication

PHILADELPHIA . . . PENNSYLVANIA

Hulburt Lubrication Engineers are available at all times for a down-in-the-mine survey without obligation. Write us Today.

HULBURT

AGAINST FRICTION



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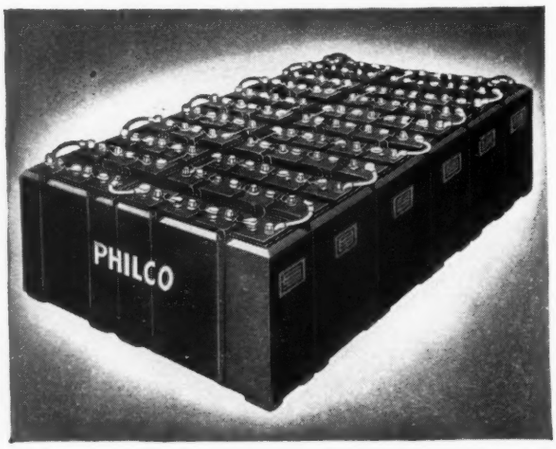

For Industrial Trucks, Mine Locomotives, Control and Auxiliary Power, Telephones, Fire Alarm and Signal Systems—there's a Philco Battery specially engineered to do the job!

Write today for the name of your local Philco sales agent . . . and the new free Philco Battery Catalog. You'll want them for reference.

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TRENTON, NEW JERSEY

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COAL AGE

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CONTENTS

VOLUME 47 OCTOBER 1942 NUMBER 10

WAR MAINTENANCE NUMBER

War Maintenance..... 65
Deep Organization..... 67
Records and Reports... 68
Deep-Mine Shops..... 70
Maintenance Supplies. 73
Lubrication Methods... 75
Wires and Cables..... 78
D.C. Substations..... 81
Mining Machines..... 83
Drilling Machines..... 85
Loading Machines..... 87
Conveying Units..... 89
Mine Locomotives..... 91
Cars and Track..... 94
Storage Batteries..... 96
Tires and Wheels..... 99
Pumps and Fans.....103
Electric Motors.....105
Control Equipment.....108
Wire Rope and Cable..110
Welding and Facing...113
Strip Organization.....116
Strip-Mine Shops.....117
Electrical Units.....120
Shovels, Draglines.....123
Drills and Pumps.....127
Trucks and Trailers....128
Preparation Plants.....131

Editorials.... 59 Manufacturers' Tips.... 137 News....61, 151

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PROGRAM NOTES—COMING ATTRACTIONS

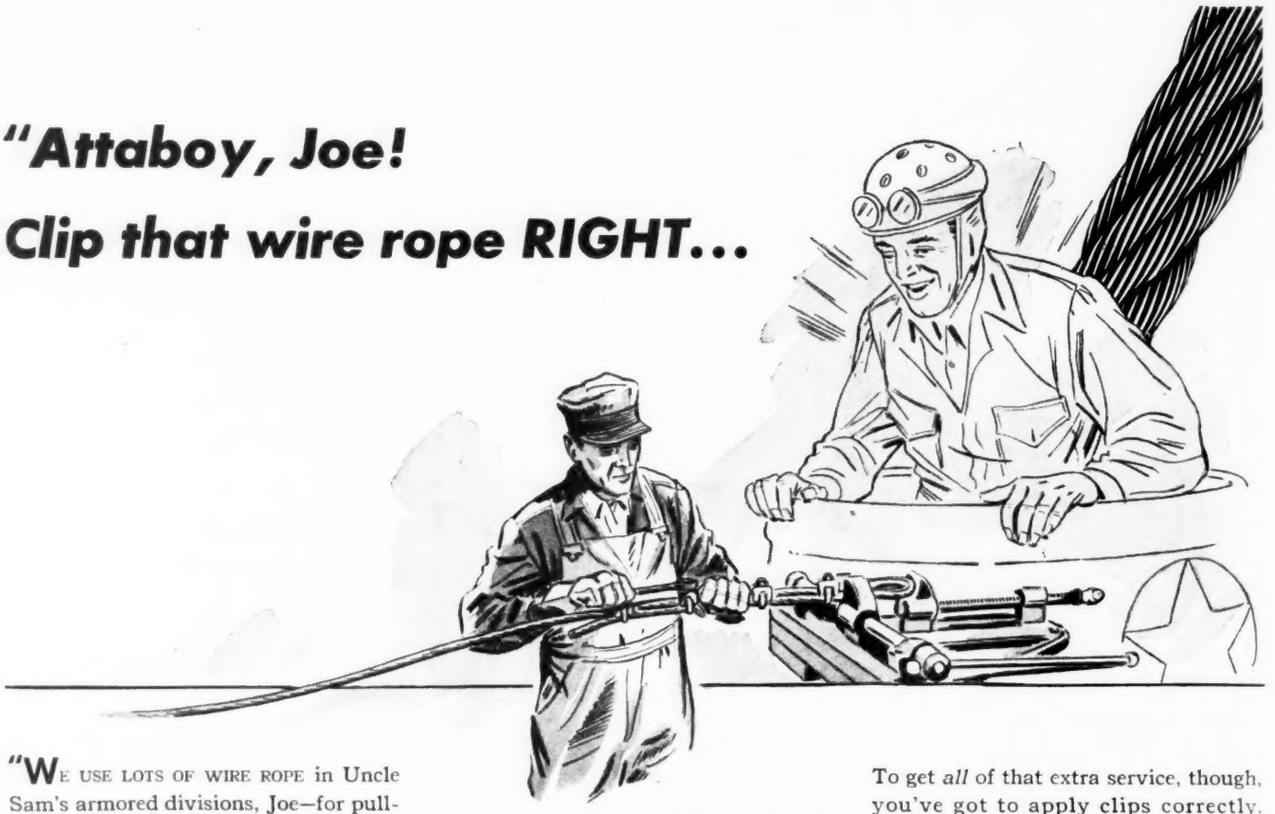
• WITH a total of 28 articles on all phases of the subject, Coal Age this month makes its contribution to the war effort with a broad-scale analysis of the subject of maintenance at coal mines. Now, more than ever before, good maintenance is absolutely essential to offset scarcity of men and materials and heavier production schedules. These are not the only benefits of good maintenance, which is one of the best possible ways of promoting efficiency and safety. Without it, results can never be as good. And the cost of keeping equipment in good condition, when production delays and other handicaps are taken into consideration, is less than poor maintenance.

• "How to do it" has been the underlying thought in the preparation of the material for this war-maintenance number. This extends from organizing for good maintenance on down to suggestions for keeping a rail bender in shape. Sections have been provided for equipment peculiar to both deep and strip mines, and many other features offer material applicable to both, such as lubrication, welding, caring for electrical equipment, maintaining wire rope and keeping preparation plants up to snuff. The aim in all cases has been to provide practical suggestions and specific recommendations for the man on the job.

• Because of space limitations and because it is believed that foremen and electrical and mechanical men, in ad-

"Attaboy, Joe!

Clip that wire rope RIGHT...



"WE USE LOTS OF WIRE ROPE in Uncle Sam's armored divisions, Joe—for pulling out of tight spots, for towing disabled tanks and trucks, for handling heavy replacement parts . . . And we use it right and *fasten* it right, because we know men's lives in battle may depend on its being just as strong as it's supposed to be!"

Keeping wire rope "just as strong as it's supposed to be" is important *wherever* wire rope is used—on fighting front or production front! One factor in rope strength is correct fastening. *Properly used*, clips make a convenient and satisfactory fastening, developing 75 to 90 per cent of the rope strength.

When we build "Blue Center" Steel Wire Rope here at Roebling, we put in all the *extra* value of 100 years of wire-rope engineering. But even "Blue Center" Steel Wire Rope can't give extra service unless *enough* clips are used in fastening. The table below gives data for clipping "Blue Center" Wire Rope.

NUMBER OF CLIPS REQUIRED FOR "BLUE CENTER" STEEL WIRE ROPES

Rope Diameter	Number of Clips	Spacing of Clips	Length of Wrench
1/2" to 5/8"	4	3 1/2" to 4 1/4"	12"
3/4" to 7/8"	5	5" to 5 3/4"	18"
1" to 1 1/8"	6	6 1/2" to 7 1/4"	24"
1 1/4" to 1 3/8"	7	8" to 8 3/4"	24"
1 1/2"	8	9 1/2"	24"

To get *all* of that extra service, though, you've got to apply clips correctly. Always use a standard wire-rope thimble. Put the clip U bolts on the dead end of the rope. Tighten bolts securely, but *do not crush rope!* Retighten all clips after an hour's full

running time and also at all regular inspections. By following these rules for proper clipping, you'll be helping to keep rope on the job for Victory.

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ROEBLING
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STEEL WIRE ROPE
PREFORMED OR NON-PREFORMED

IRON AND STEEL ARE DESPERATELY NEEDED! Throw Your Scrap into the FIGHT!

dition to others, will find much of direct value in solving their problems in the 28 articles in this number, three departments have been omitted from this issue, namely: the Foremen's Forum, State-Board Questions and Timely Operating Ideas. They will be back stronger than ever in the November Coal Age, however.

• Maintenance will continue to feature succeeding issues, with articles now in the box on such subjects as wire rope, armatures and lightning protection. J. A. Civilett, of Westinghouse, is the author of the latter, addressing himself to the subject of protecting motors and generators. His material includes wiring diagrams, equipment tables and cost data. Look for it early.

• Protection of men riding in mantrips is a subject worthy of more attention. The Weirton Coal Co., Isabella, Pa., has solved the problem by installing special cars, armored on the tops and sides. They ride like Pullmans, says S. M. Cassidy, manager, whose descriptive article will appear in the next issue.

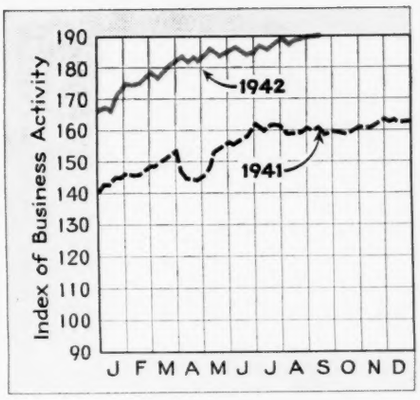
• Floods are among the things that many mining men must cope with in addition to their other problems. Many anthracite properties had another session this year, which prompted an article on control scheduled for an early number. Stream patrol and study are suggested remedies.

• Aside from floods, water is a constant factor in the operation of mines, and handling it as cheaply as possible naturally is the goal of the management. The Pursglove Coal Mining Co., in northern West Virginia, licked one problem by installing a deep-well turbine pump, which, among other things, displaced six underground pumps totaling 285 hp. The new pump takes 38 hp. This article also will appear in an early issue.

• Mechanical-mining material in the November number will include an article on the use of shuttle cars and mobile equipment in mining old pillars at the Alpine mine, Baldwin, Colo. With one unit (two cars and a loader) and 13 men, the performance is 300 tons per shift in 7 ft. of coal on an 8-percent pitch.

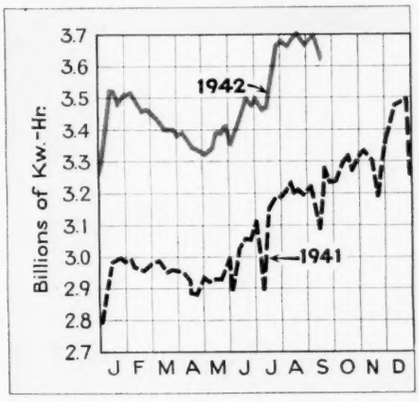
• Use of electronic devices in leveling shovels automatically is one of the subjects on the stripper bill of fare. W. E. Gildersleeve, Marion Steam Shovel Co., and D. Stoetzel, General Electric, are the authors.

HOW'S BUSINESS



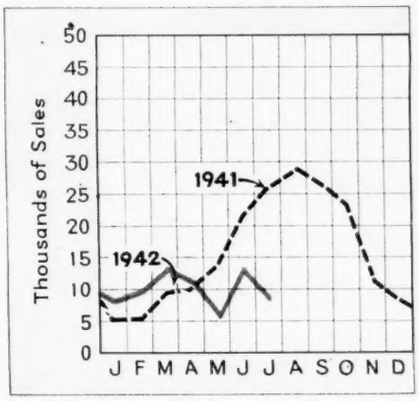
GENERAL BUSINESS CONDITIONS

War developments in Russia, inflation and rubber loom larger in the business outlook, according to *Business Week*. Ship needs as well as the fuel oil pinch have been lightened by extension of oil rationing; curtailment of tire use for non-essential purposes may come after election. Wage control and ceilings on farm prices are in for congressional pressure to soften stabilization, with some halt in the price spiral certain. Mounting output of war weapons foreshadows further curtailment of non-war lines. Business Week Index was at 186.3 for the week ended Sept. 12, compared with 185.1 a month earlier and 161.2 a year previous.



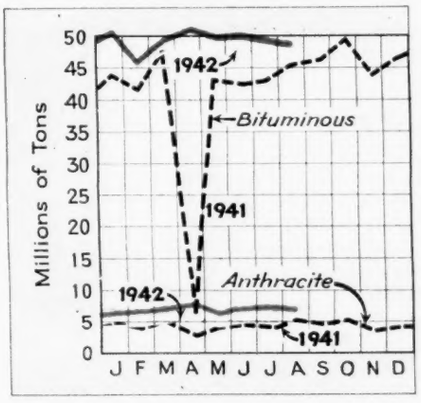
ELECTRIC POWER OUTPUT

Production of electric energy by the electric light and power industry registered the seasonal decline usual during the first half of September, according to the Edison Electric Institute. For the fortnight ended Sept. 12, as compared with the same period a year ago, however, there was an increase of 12.2 percent. The Pacific Coast region continued to lead in percentage of increase. Country-wide figures for recent weeks are: Aug. 22, 3,674,000,000 kw.-hr.; Aug. 29, 3,640,000,000; Sept. 5, 3,672,921,000; Sept. 12, 3,570,919,000 kw.-hr.



COAL STOKER SALES

Sales of mechanical stokers in July last totaled 7,432 units (U. S. Bureau of the Census from 101 manufacturers), compared with 11,784 units in the preceding month and 26,453 in July, 1941. Sales of small units in July last were: Class 1 (less than 61 lb. of coal feed per hour), 6,355 (bituminous, 5,349; anthracite, 1,006); Class 2 (61–100 lb. per hour), 431 (bituminous, 408; anthracite, 23); Class 3 (101–300 lb. per hour), 220.



COAL PRODUCTION

Bituminous coal produced by United States mines in August last (preliminary) totaled 47,160,000 net tons, according to the Bituminous Coal Division, U. S. Department of the Interior. This compared with an output of 47,700,000 tons in the preceding month and 46,651,000 tons in August, 1941. Anthracite tonnage in August last, according to the U. S. Bureau of Mines (preliminary), was 5,180,000, as against 5,341,000 (revised) in the preceding month and 5,441,000 tons in August, 1941.

(All weighed-in on the platform scale, another Mack-load of coal gets the go-ahead and rolls away. Sketched from life, near Scranton, by Peter Helck.)

Well-known American, at work!

THE SAYING "Built like a Mack Truck" is something more than a slang phrase. It is an acute observation on the difference between a Mack . . . and just a truck! It worked into the language because of the way a Mack works into a job. The first Mack, built in 1900, served 17 years. No one knows . . . *yet* . . . what records today's Macks will make. But you can put it down as sure that the first Mack, today's Mack, tomorrow's Mack . . . all set out to be the *best* trucks in the world when made!

Mack Trucks, Inc., New York, N. Y. Factories at Allentown, Pa.; New Brunswick, N. J.; Plainfield, N. J.; Factory branches and dealers in all principal cities for service and parts.

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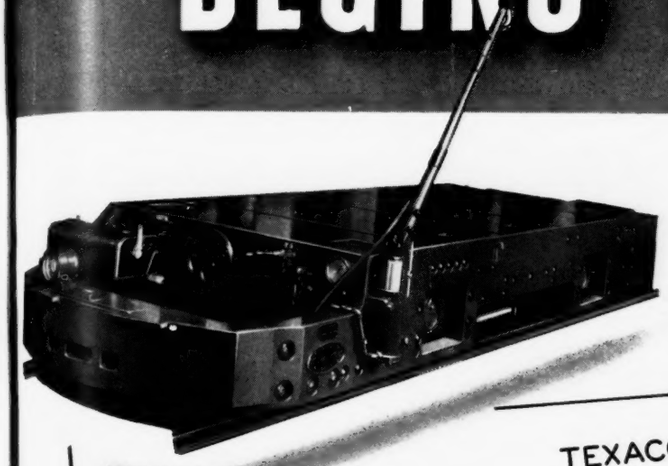
TRUCKS
FOR EVERY PURPOSE
ONE TON TO FORTY-FIVE TONS
BUY U. S. WAR BONDS

IF YOU'VE GOT A MACK, YOU'RE LUCKY . . . IF YOU PLAN TO GET ONE, YOU'RE WISE!

War-Time Maint

BEGINS WITH EFFECTIVE

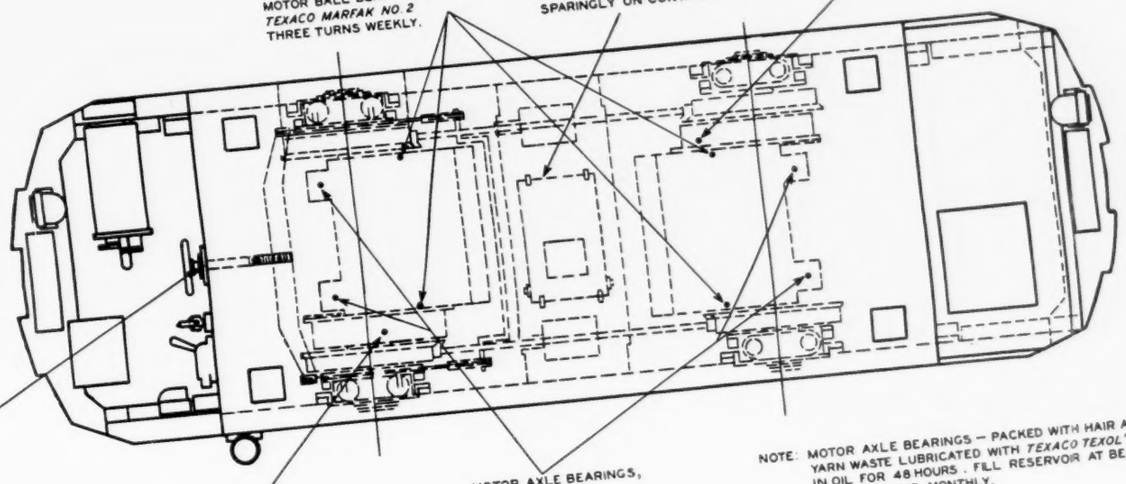


TEXACO MAINTENANC

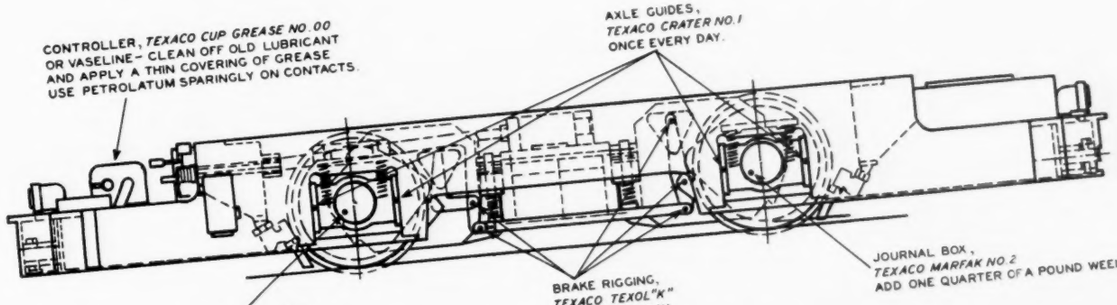
TEXACO MAINTENANCE LUBRICATION CHART

GOODMAN 165 MINE LOCOMOTIVE

100 H.P. — 15 TONS — 30" HIGH


MOTOR BALL BEARINGS, TEXACO MARFAK NO. 2 THREE TURNS WEEKLY.
REVERSER, TEXACO CUP GREASE NO. 2 TWO TURNS PER WEEK. USE PETROLATUM SPARINGLY ON CONTACTS.
GEAR CASE, TEXACO CRATER NO. 1 ADD ONE POUND WEEKLY.
BRAKE SCREW, TEXACO TEXOL "K" ONCE EVERY DAY.
GEAR CASE, TEXACO CRATER NO. 1 ADD ONE POUND WEEKLY.
MOTOR AXLE BEARINGS, TEXACO TEXOL "K" FILL EVERY SHIFT.

NOTE: MOTOR AXLE BEARINGS — PACKED WITH HAIR AND LONG FIBRE-WOOL YARN WASTE LUBRICATED WITH *TEXACO TEXOL "K"*. SOAK YARN WASTE IN OIL FOR 48 HOURS. FILL RESERVOIR AT BEGINNING OF EVERY SHIFT. CHANGE WASTE MONTHLY.


CONTROLLER, TEXACO CUP GREASE NO. 00 OR VASELINE — CLEAN OFF OLD LUBRICANT AND APPLY A THIN COVERING OF GREASE USE PETROLATUM SPARINGLY ON CONTACTS.
AXLE GUIDES, TEXACO CRATER NO. 1 ONCE EVERY DAY.
JOURNAL BOX, TEXACO MARFAK NO. 2 ADD ONE QUARTER OF A POUND WEEKLY.
BRAKE RIGGING, TEXACO TEXOL "K" ONCE EVERY DAY.
JOURNAL BOX, TEXACO MARFAK NO. 2 ADD ONE QUARTER OF A POUND WEEKLY.

CHARTS FOR UNDERGROUND MACHINERY ARE AVAILABLE

TEXACO MAINT

Maintenance

'IVE LUBRICATION

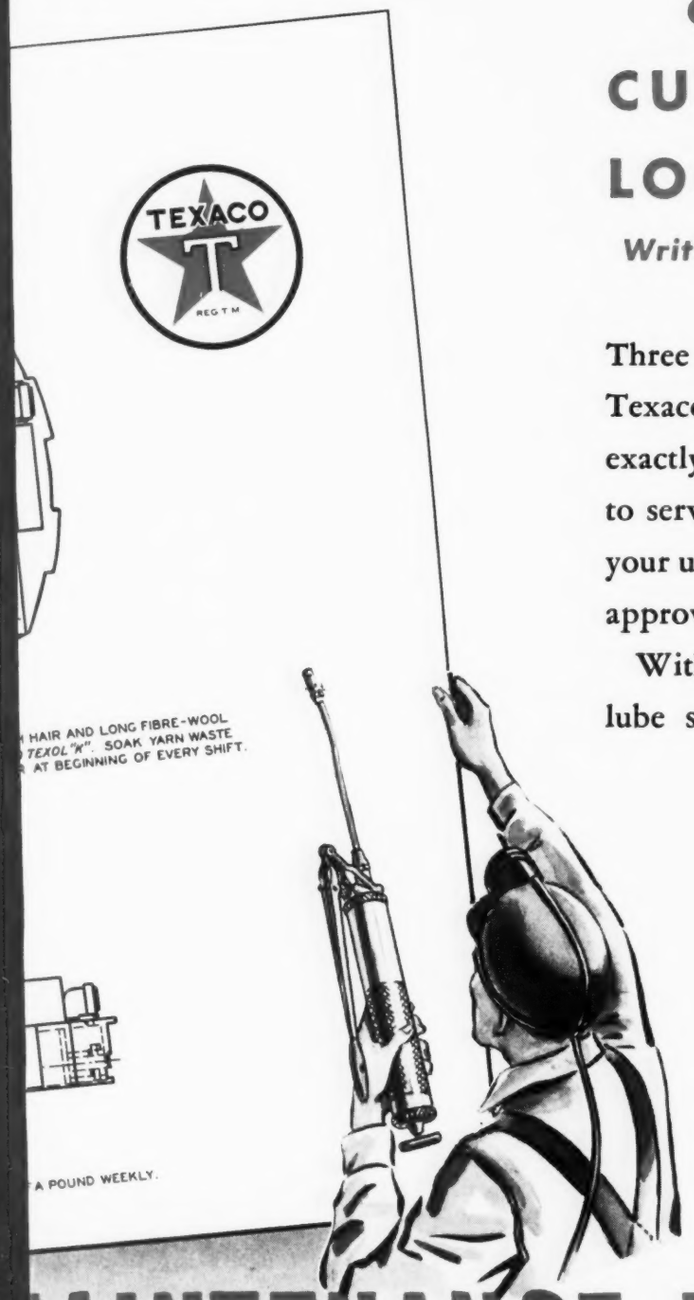
ENANCE LUBRICATION CHARTS

are available for

CUTTERS, LOADERS,

LOCOMOTIVES, etc.

Write for yours today. No obligation.



Three times the size of the chart illustrated, Texaco Maintenance Lubrication Charts show exactly *where, when* and with *what* lubricant to service each and every lubrication point of your underground machines...with lubricants approved by the manufacturer.

With these charts displayed and used at all lube stations in the mine, your equipment will give maximum service, stay out of the repair shop.

ORDER CHARTS BY MAKE AND MODEL, WRITE TO: The Texas Company, *National Sales Division,* Dept. C, 135 East 42nd Street, New York, N. Y.

AINTENANCE LUBRICATION

FOR THE COAL MINING INDUSTRY

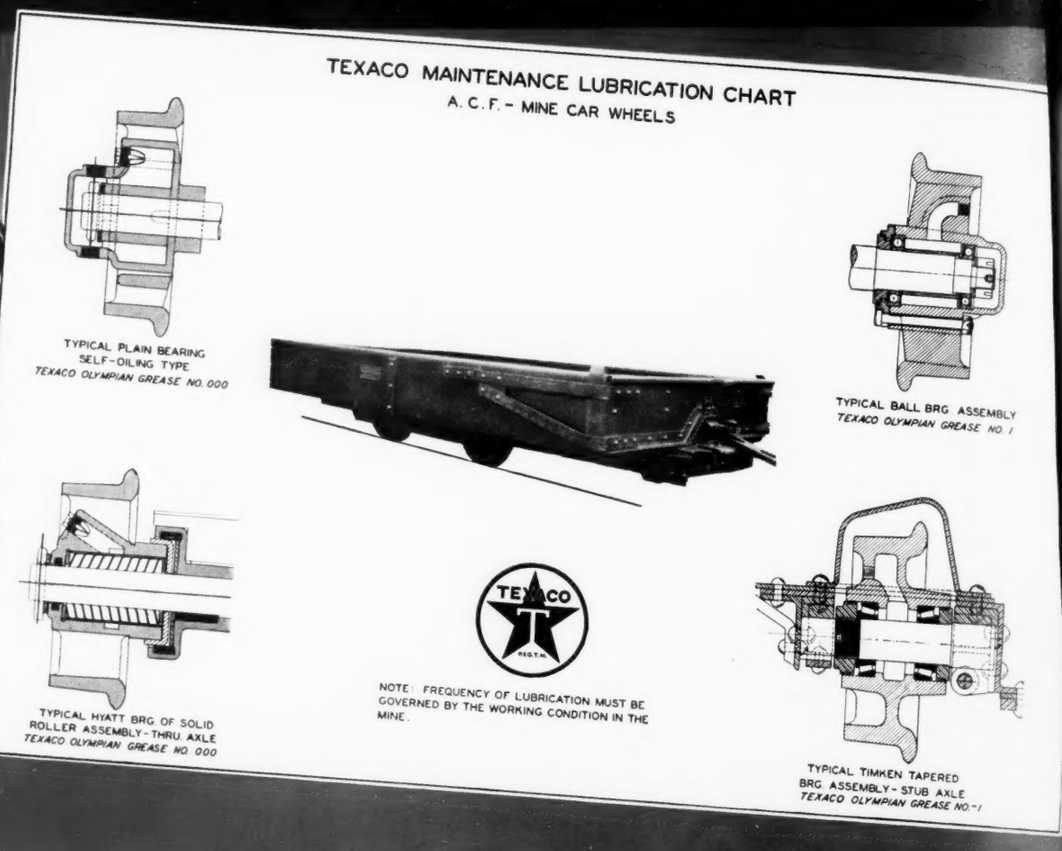
Evidence that the coal industry is producing at a faster rate than at any time in history, is before the nation.

Evidence also rolls in that scientific lubrication with Texaco Maintenance Lubrication Charts is playing a vital part in keeping equipment going . . . in the face of the industry's all-out war effort.

To keep *your* equipment on the job 24 hours a day, every day, follow the Texaco Maintenance Lubrication Charts now available to coal operators everywhere.

See the Lubrication Chart
ON THE INSIDE OF THIS FOLDER

Reducing Friction
IN MINE CAR WHEELS


TEXACO MAINTENANCE LUBRICATION CHART
A. C. F. - MINE CAR WHEELS
TYPICAL PLAIN BEARING SELF-OILING TYPE
TEXACO OLYMPIAN GREASE NO. 000
TYPICAL BALL BRG. ASSEMBLY
TEXACO OLYMPIAN GREASE NO. 1
TYPICAL HYATT BRG. OF SOLID ROLLER ASSEMBLY - THRU. AXLE
TEXACO OLYMPIAN GREASE NO. 000
NOTE: FREQUENCY OF LUBRICATION MUST BE GOVERNED BY THE WORKING CONDITION IN THE MINE.
TYPICAL TIMKEN TAPERED BRG. ASSEMBLY - STUB AXLE
TEXACO OLYMPIAN GREASE NO. 1

Because each mine operates so many of them, mine car wheels are vitally important in any program to reduce frictional drag, keep equipment out of the shop, and save maintenance money.

Texaco Maintenance Lubrication Charts cover mine car wheels, too. Order by make and model.

In using Texaco Lubricants, you get the same high quality as enjoyed by the U. S. Navy, Coast Guard, Army Engineers, as well as the industries listed in the panel.

Address your requests for charts to:

THEY PREFER TEXACO

★ More locomotives and cars in the U. S. are lubricated with Texaco than with any other brand.

★ More revenue airline miles in the U. S. are flown with Texaco than with any other brand.

★ More buses, more bus lines and more bus-miles are lubricated with Texaco than with any other brand.

★ More stationary Diesel horsepower in the U. S. is lubricated with Texaco than with any other brand.

★ More Diesel horsepower on streamlined trains in the U. S. is lubricated with Texaco than with all other brands combined.

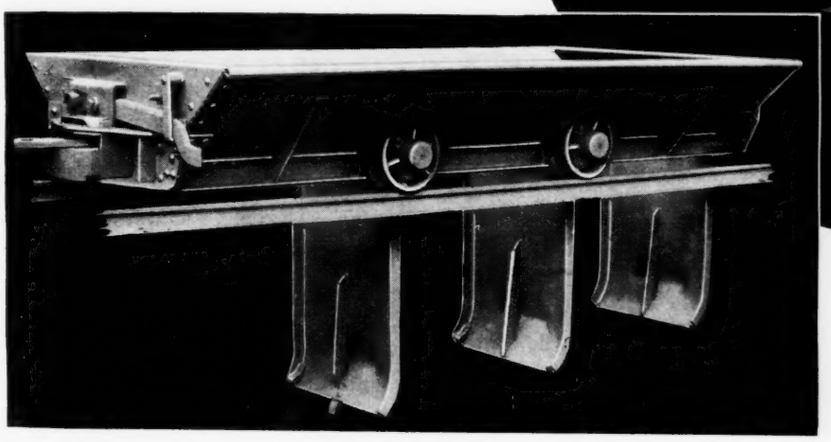
THE TEXAS COMPANY

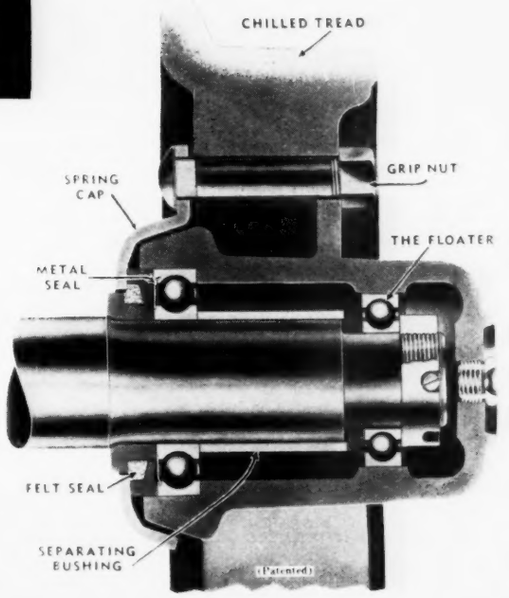
NATIONAL SALES DIVISION, Dept. C
135 East 42nd Street, New York, N. Y.

Unlatching "Automatics" Electrically

—is another Sanford-Day Event

The photo at right is a picture of the latch-end of an S-D "Automatic" mine car which has our new, automatic, electrically operated, unlatching device. This car has no latch lever and nothing projecting beyond car. It is the last word in streamlining the method of discharging cars, and its operation is extremely simple. Below we show a car with the regular unlatching mechanism for dropping doors. This new electric device represents another Sanford-Day accomplishment, for which we continually strive to more and more reduce the cost of coal production. And every time you purchase S-D mine cars you will find in them some new improvement in design or method which reduces the cost of producing coal.





● When the car equipped with the electric unlatching device arrives at the dumping bin, contact is made simply and safely and in such fashion as to complete an electric circuit which actuates the solenoid and causes the doors to be released for falling. The doors are released instantly and they discharge the coal in the usual 1-2-3 "Automatic" manner. Doors close in the usual way also. The electric power comes from the same source as that which supplies the power for operating other mine equipment.

With S-D 1-2-3 "Automatics" . . . with this new foolproof type of unlatching device . . . with the S-D "Floater" Ball Bearing Wheel, we offer you the most modern and, definitely, the greatest money saving cars available. Let one of our representatives give you complete details of this equipment. Drop us a line now!

Sanford-Day Iron Works, KNOXVILLE, TENNESSEE

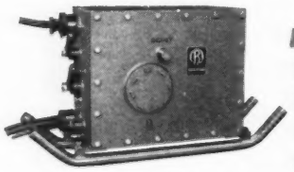
It's No Secret—

That Proper Maintenance

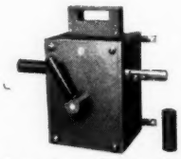
Neither is it a secret that mining materials today *must* last longer in spite of staggering production schedules. Because our stake in the mining industry deals with the handling of electrical power—a vital part of your operating system—we would like to point out several significant answers to the following requirements for a continuous supply of power from substation to face—*Buy the most dependable materials available; keep them in peak operating condition.*

TROLLEY CLAMPS Inspect to see if tight and serviceable. Jaws often become worn thin and are apt to drop the wire unless replaced. There is also a possibility of the clamp becoming "cocked" placing a kink in the wire. Such kinks should be removed with a hammer and block of wood.

SPLICERS Tighten all set screws and see that a smooth approach exists. If lip and runner have become worn thin, these should be replaced as trolley wire may be pushed through from bottom.



MOTOR STARTERS Have a spare starter on hand so that each starter may be taken out of the mine periodically for a complete overhaul. Contacts should be carefully sanded to preserve original contacts and remove rough spots and corrosion. Make certain that the case is kept clean of coal particles which might make the mechanism inoperative. Starter adjustments should be checked periodically to prevent burning out the resistances.



CIRCUIT BREAKERS A circuit breaker is a protective device. If it keeps going out, the chances are that the combined load is too much for the particular setting. See that the inside of the case is free from coal particles as such make the mechanism inoperative.

HEADLIGHTS Be sure locomotive headlights are properly focused for maximum light efficiency. Remove lens door and polish reflector at regular intervals. Be sure resistances are set properly to accommodate changes in voltage. Overvoltage will shorten bulb life considerably.

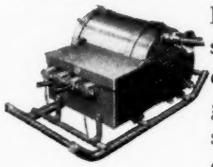
BONDS Inspect rail bonds visually every month. Make a meter check as often as possible. Cross bonding at regular intervals is important. See that your circuit is bonded to capacity. It is wise to standardize on a bond that may be reclaimed easily. O-B's Wedge Bond and AW-20 are excellent examples.

FUSED TROLLEY TAPS Keep properly fused for protection of cable. After replacing burnt-out fuse, be certain that the tap is screwed together tightly and that all contacts are themselves tight.

Makes Good Materials Last Longer :

Suggested and designed by men in the mining business, O-B materials have been the accepted standard for mine power systems over a period of many years. With O-B mining materials, you can be absolutely sure that you're getting ample mechanical and electrical strength, a wide margin of safety and extra service life. But all materials require proper maintenance. To help you get the most from your men, materials and machines, here are a few maintenance tips that may prove of value:

JUNCTION AND DISTRIBUTION BOXES



Inspect to see that the prongs of split-terminal plugs provide a firm contact all the way around. To get a good spring fit, it is wise to sand the surfaces and spread the fingers slightly.

CURRENT COLLECTORS

For maximum efficiency and longer wire life, standardize on shoe collection. Use a good wire conditioning preparation or lubricant to keep the underside of the wire smooth and burnished for efficient shoe collection. When bright copper begins to appear, make another application of the lubricant.

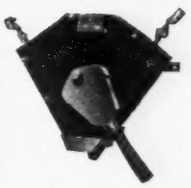
FEEDER TAPS See that taps to positive feeder or from negative feeder to rail are properly connected and maintained at regular intervals. Insulation should be maintained where such is required.

SECTION INSULATOR SWITCH Be certain that the blade is straight and engages the jaws snugly. A little vaseline on the jaws is often helpful. Burned jaws should be replaced so the switch will not heat up. It is also a good idea to inspect the end castings to see that the wires are tight and the approaches smooth.

FROGS Inspect as to track location as track may often be shifted and frog remain in same position. Clamping device should be checked to see that the wire is held properly and cam tips and approaches should be adjusted for a smooth approach.

RECLAIMED MATERIALS Hangers, clamps, expansion bolts, etc., salvaged from a dismantled trolley installation should be cleaned and given a bath of penetrating oil. These may then be stored for future installation. O-B line materials are noted for their reclaimability.

SAFETY FEEDER SWITCHES



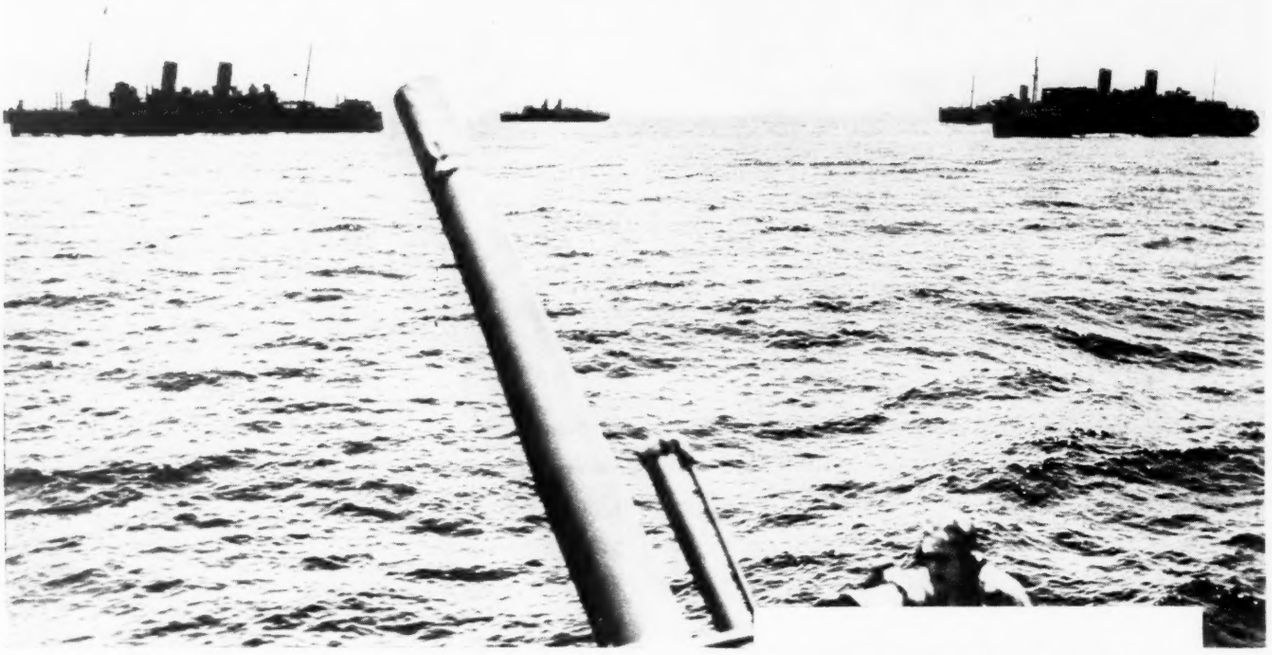
Make certain that the operating mechanism in the interior of the case is kept free of obstructing foreign elements. A little vaseline on the jaws is often quite helpful. Contacts should be kept clean and tight.

Ohio Brass

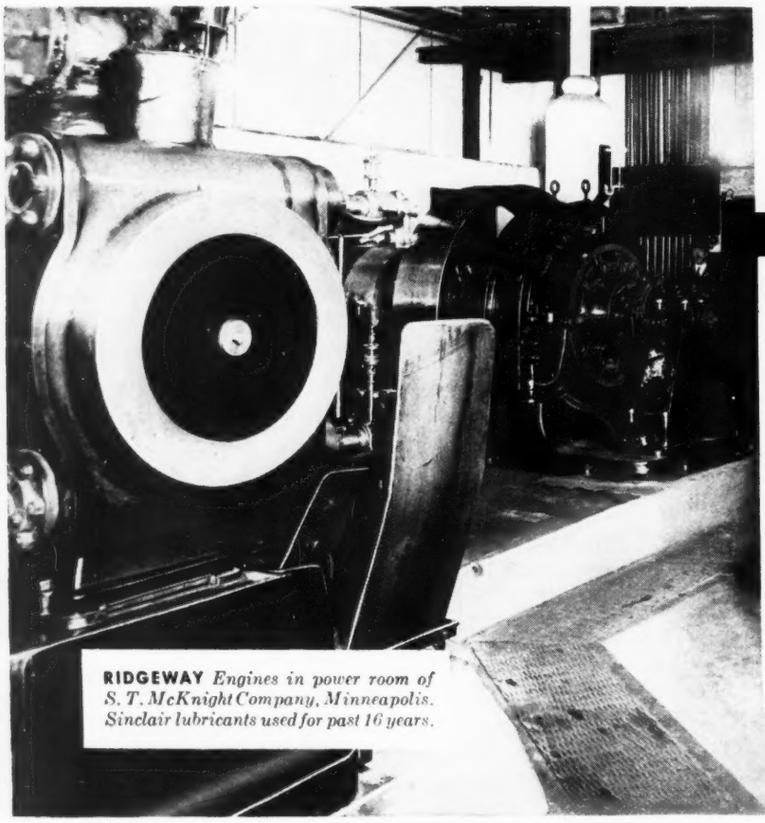
2302-M

MANSFIELD, OHIO

CANADIAN OHIO BRASS CO., LTD., NIAGARA FALLS, ONT.



MAINTENANCE is today's problem at the front and *at home*. For full maintenance of *STEAM ENGINE* efficiency and avoidance of replacement shutdowns use . . .



RIDGEWAY *Engines in power room of S. T. McKnight Company, Minneapolis. Sinclair lubricants used for past 16 years.*

. . . SINCLAIR STEAM CYLINDER and VALVE OILS. These oils correctly meet all combinations of service requirements in steam plant operation, at low lubrication cost.

Write for "The Service Factor"—a free publication devoted to the solution of lubricating problems.

SINCLAIR INDUSTRIAL OILS

FOR FULL INFORMATION OR LUBRICATION COUNSEL WRITE NEAREST SINCLAIR OFFICE

SINCLAIR REFINING COMPANY (Inc.)

2540 West Cermak Road, Chicago • 10 West 51st Street, New York City • Rialto Bldg., Kansas City • 573 West Peachtree Street, Atlanta • Fair Building, Ft. Worth

Maintenance starts with the Shot

AMERICAN
CYANAMID & CHEMICAL CORPORATION

EXPLOSIVES

Correct Coal Sizing will minimize maintenance *right down the line*

BREAKING coal down into the right sizes — avoiding fines as well as big lumps — is the result of correct blasting practice. It means minimizing wear and tear on loaders, conveyors, cars, hoists, dumpers and tipples. It helps every piece of equipment work at its best, with the least maintenance cost.

AMERICAN Explosives and Blasting Supplies are made under exacting specifications in well equipped plants. Chemical control and thorough inspection insure adherence in manufacture to the methods and processes developed by our research.

Today, as never before, efficient blasting is all-important. Capable technical service men are available to assist you with your blasting problems.

- **HIGH EXPLOSIVES**
- **PERMISSIBLES**
- **BLASTING POWDER**
- **BLASTING ACCESSORIES**

American Cyanamid & Chemical Corporation

A Unit of American Cyanamid Company

30 ROCKEFELLER PLAZA • NEW YORK, N. Y.

EXPLOSIVES DEPARTMENT

SALES OFFICES: Pittsburgh, Pa. Bluefield, West Va. Scranton, Pa. St. Louis, Mo. Chicago, Ill. Pottsville, Pa. Hazleton, Pa. Maynard, Mass.

GOOD M

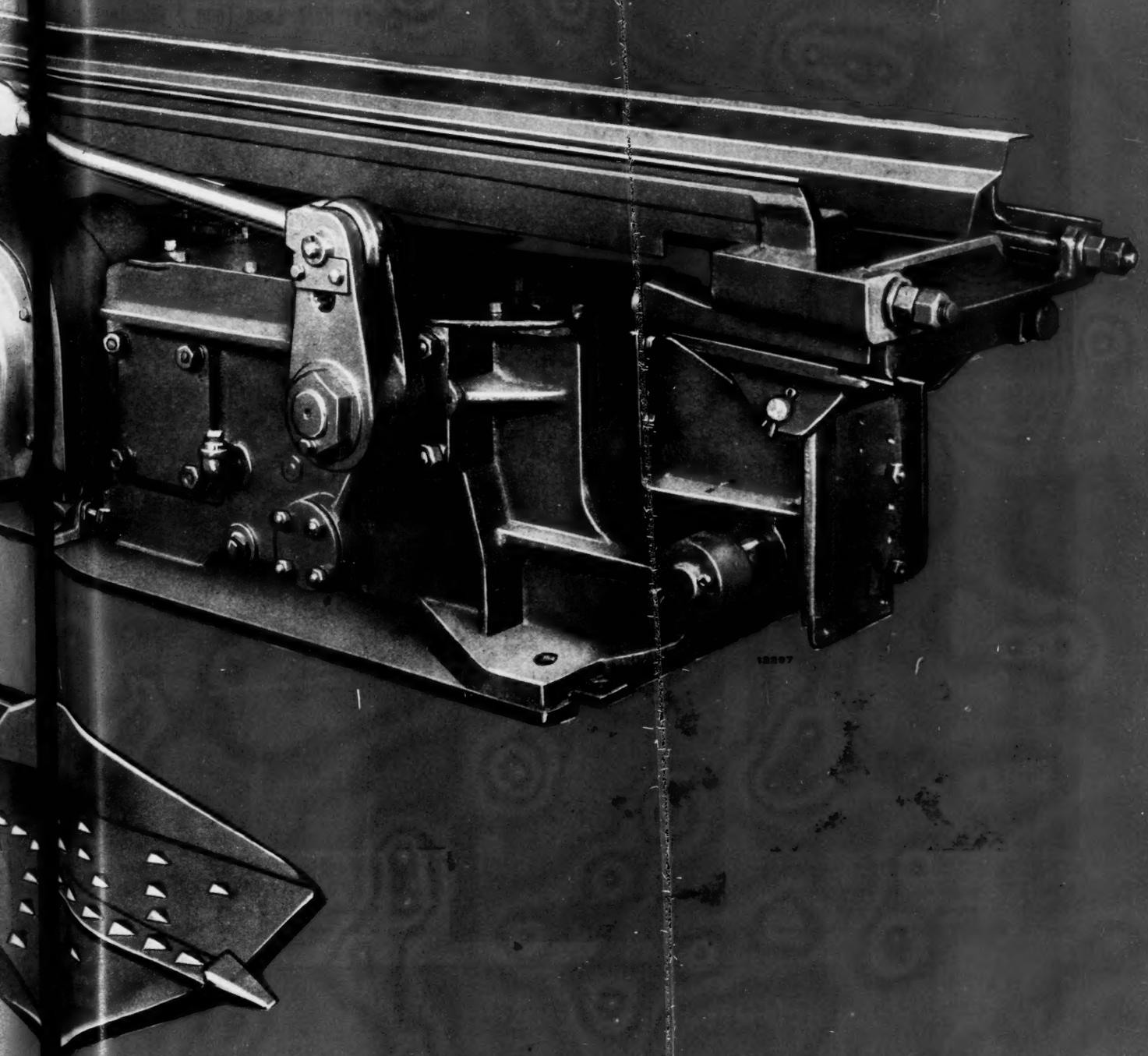
Shaker Conveyors

. . . a high capacity loading and transporting system that provides for a continuous flow of coal from face to entry, can be adapted to any mining condition and has an extremely low maintenance cost.

For an estimate showing how this equipment can help you, consult a Goodman sales engineer.

GOODMAN MANUFACTURING COMPANY

MAN
and Duckbills



HALSTED STREET AT 48TH • CHICAGO, ILLINOIS

30 6-FOOT HOLES IN 58 MINUTES, 49 SECONDS

↑ **LESS THAN TWO MINUTES** per 6-foot hole was the average of this CP-572 Open Type Hand-Held Electric Coal Drill during recent time study in a West Virginia coal mine, Island Creek seam, noted for hard drilling; 1½" heavy duty oval auger.

INTERESTING TIME-STUDY OF CP HAND-HELD COAL DRILL

Average Per Hole, Less Than 2 Minutes

WEST VIRGINIA (CP)—In Island Creek seam, noted for hard drilling, a CP-572 Hand-Held Electric Coal Drill recently drilled thirty 6-foot holes in the same section in a total elapsed time of 58 minutes, 49 seconds, including bit change. Drilling time per hole ranged from 1 minute, 25 seconds, to 2 minutes, 45 seconds — an average of less than two minutes per hole.

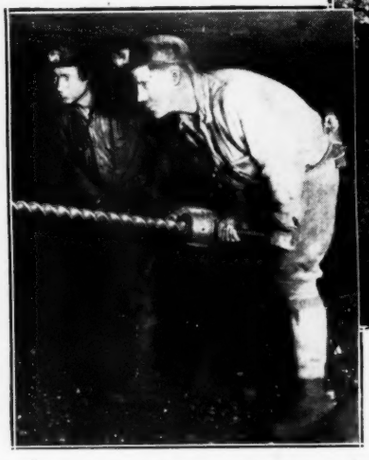
Write for complete data on the four types of CP Hand-Held Electric Coal Drills, with permissible or open type motors.

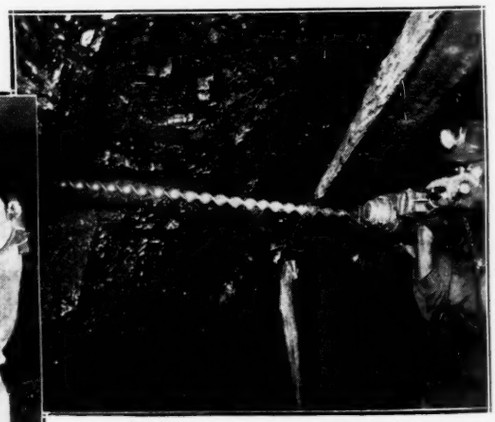
CHICAGO PNEUMATIC TOOL COMPANY

General Offices: 8 E. 44th St., New York, N. Y.

WORLD'S FASTEST COAL DRILL — the CP → "Whippet". Completely enclosed adjustable safety clutch, auger chuck, motor and gears make the "Whippet" Drill as safe as it is speedy.

← **FOR NINE MONTHS,** a CP-572 Electric Coal Drill was used by two 7-hour shifts each work day, averaging forty 6-foot holes per shift—with only negligible maintenance.





↑ **ONE MAN CAN EASILY HANDLE** the "Whippet" Electric Coal Drill in the softer seams without fatigue. Removal of dead handle permits parallel drilling within two inches of either top or bottom.

CHICAGO PNEUMATIC

ELECTRIC COAL DRILLS

ALSO: Air Compressors, Pneumatic Tools, Electric Tools, Rock Drills, Hydraulic Aviation Accessories, Diesel Engines

POST-MOUNTED HAND-HELD ELECTRIC AND PNEUMATIC TOOLS FOR MAINTENANCE AND REPAIR

Meet WAR Production Needs Safely . . . Sv

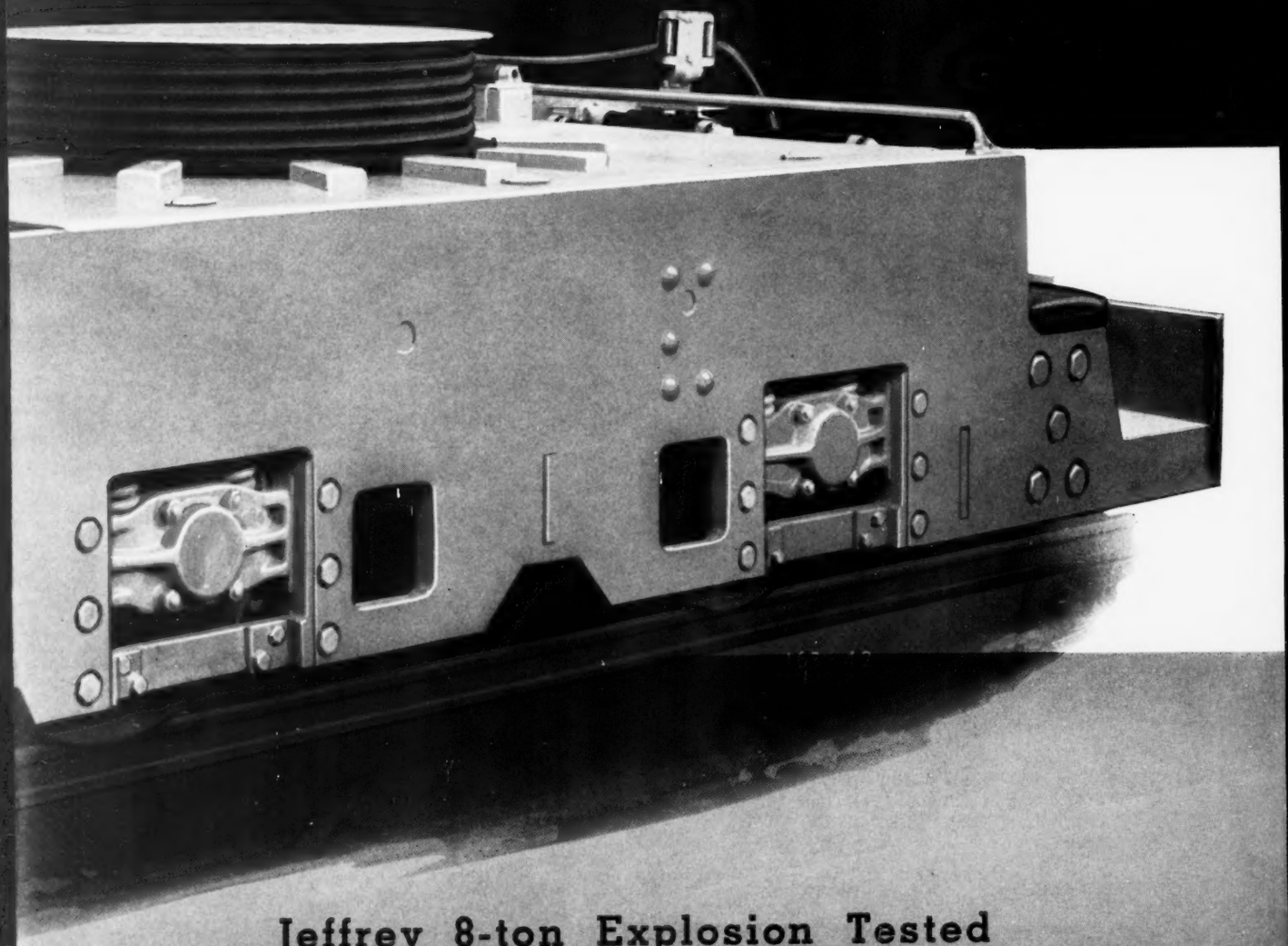
Jeffrey LOCO

Jeffrey Locomotives, speeding mine transportation for over sixty years

See back page for Maintenance Hints on Jeffrey Locomotives.

. . . Swiftly . . . Economically . . .

COMOTIVES



Jeffrey 8-ton Explosion Tested
Gathering Locomotive . . .

JEFFREY
EQUIPMENT for MECHANIZED MINING

CUTTERS
DRILLS
LOADERS
CONVEYORS
LOCOMOTIVES
FANS
BLOWERS
JIGS
CRUSHERS
SCREENS
RENEWAL PARTS

BELOW AND ABOVE GROUND
FROM FACE TO RAILROAD CAR

LOCOMOTIVE

MAINTENANCE HINTS

To get continuity of service and maximum production from your locomotive, with the least time out for repairs:

1. KEEP THE LOCOMOTIVE CLEAN

At least twice a week, using compressed air, blow out dirt in cab, from around controller, motors, resistor, contactors, relays, cable reel, transfer switch, any auxiliary switches, and wiring.

Keep commutators and brush holders clean; the former free from grease, the brushes operating freely in the holders.

Look inside motor frames occasionally—remove accumulation of dirt or grease. If found — remove cause.

Keep inside of all electrical enclosures clean.

Cleanliness prevents electrical breakdown — often reveals minor defects than can be corrected before they result in breakdowns requiring major repairs.

2. MAKE SCHEDULED INSPECTIONS

All operating parts, electrical and mechanical.

See that all control contacts make good contact. Dress down with smooth file any blistered or excessively rough surfaces. Replace before too worn to function properly.

Replace any arc barriers before completely burned through.

Check electrical connections to see that they are tight.

Check resistor to see that there are no signs of burning.

Check bearings (armature, motor axle suspension, journal, and equalizer) to ascertain that they are taking lubricant properly . . . replace before excessively worn.

Check journal box guides and brake rigging.

Apply and release brakes to check adjustment of brake shoes and need for renewal.

Inspect sanding equipment — see that sand runs freely from each spout and strikes rails properly.

Keep cable reel adjusted for proper tension in cable. Cable is particularly difficult to replace.

3. LUBRICATE AT REGULAR INTERVALS

Use proper kind and proper amount, as required, on all bearings, linkages, and brake screw. All lubricants and lubricating devices should be handled so that they do not become contaminated with foreign matter.

4. DO NOT OVERLOAD LOCOMOTIVE

Note temperature of motors occasionally at end of shift. Overheating causes insulation to deteriorate, necessitates more frequent rewinding, and interferes with proper lubrication of motor bearings.

Keep down the load hauled to capacity of locomotive. A few LESS CARS PER TRIP may haul MORE COAL PER SHIFT with much less maintenance.

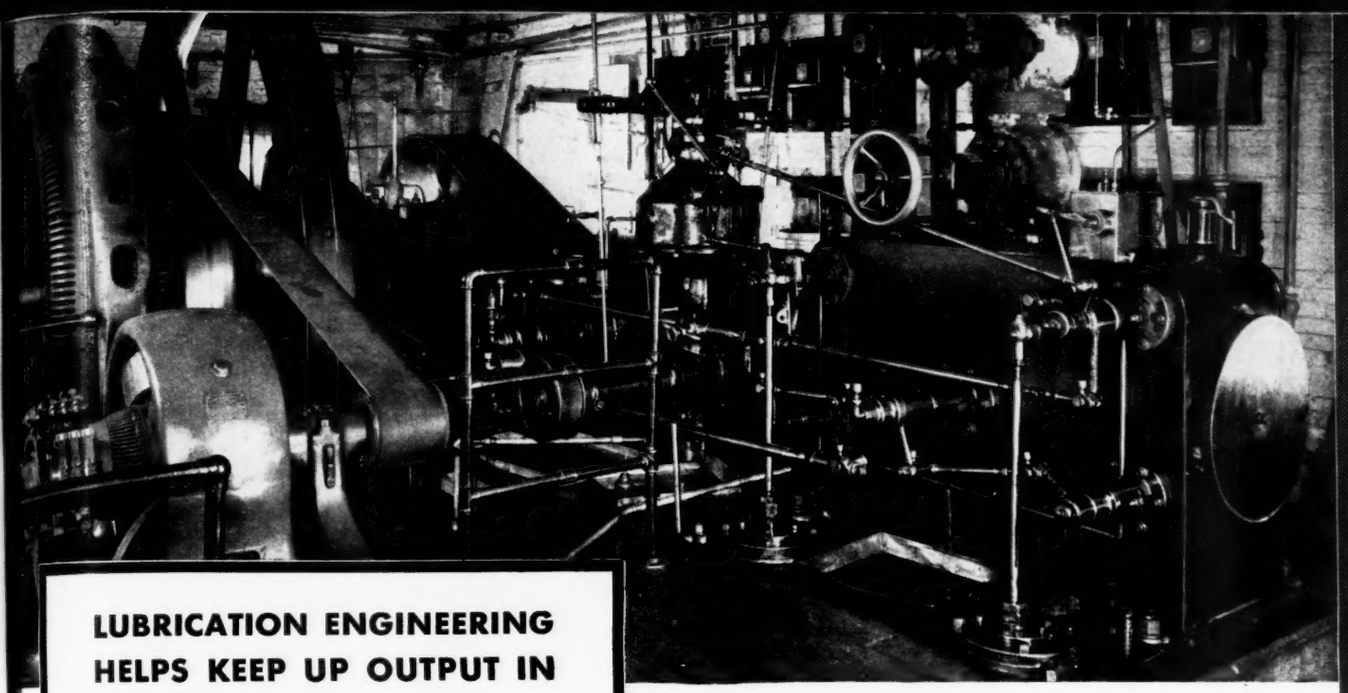
A locomotive properly loaded uses sand sparingly, only on occasional adverse track conditions.

THE JEFFREY MANUFACTURING COMPANY

912-99 North Fourth Street, Columbus, Ohio

Sales Offices: Baltimore, Birmingham, Boston, Buffalo, Chicago, Cleveland, Cincinnati, Detroit, Denver, Harlan, Houston, Huntington, Milwaukee, New York, Philadelphia, Pittsburgh, Scranton, St. Louis, Salt Lake City

Service Stations: Pittsburgh, Harlan, Ky., Birmingham, St. Louis, Logan-Beckley, W. Va., Scranton



LUBRICATION ENGINEERING HELPS KEEP UP OUTPUT IN THESE TYPICAL PLANTS

PROBLEM—Excessive valve wear developed on the Corliss engine pictured above in a Wisconsin manufacturing plant. The engine would not pull its normal load—steam consumption was so high it was necessary to shut down to build up steam pressures.

SERVICE—Indicator cards were taken by the Standard Oil Engineer. Valves were set, new piston rings installed, and the engine started on Stanocyl Steam Cylinder Oil.

RESULT—The engine now operates satisfactorily on all loads—steam pressure is adequate and no time is lost in shutdowns. This, plus a 30% reduction in lubricating costs.

• • •

PROBLEM—To double flour production, a central states mill had to increase capacity of the Corliss engine. Boiler pressures were raised from 140 lbs. to 180 lbs. Engine speed was increased from 80 RPM to 120 RPM. Because of increased pressures and speed, frequent inspections were made. These soon revealed a marked increase in piston and ring wear. Oil carryover became a serious problem.

SERVICE—A Standard Lubrication Engineer analyzed operating conditions. A force feed lubricator and atomizer were installed. The engine was started on a high grade Standard cylinder oil, and feed adjusted to one pint of oil per million sq. ft. of rubbing surface.

RESULT—The reduced feed helped eliminate oil carryover—effecting a worthwhile saving in boiler cleaning labor and promoting safer boiler operation. Frequent inspections showed ring wear was reduced 75%—indicating adequate lubrication. Most important, the Engineer's recommendations answered this operator's question on how to avoid shutdowns and excessive maintenance.

OIL IS AMMUNITION . . . USE IT WISELY

AVOID SHUTDOWNS ON OVERWORKED STEAM ENGINES

• Are power demands pushing your generating equipment to the limit? If so, there are a number of questions which you'd like answered. How long will your equipment stand the added strain? How soon will shutdowns for maintenance seriously cut into power output? What can you do to avoid excessive repairs?

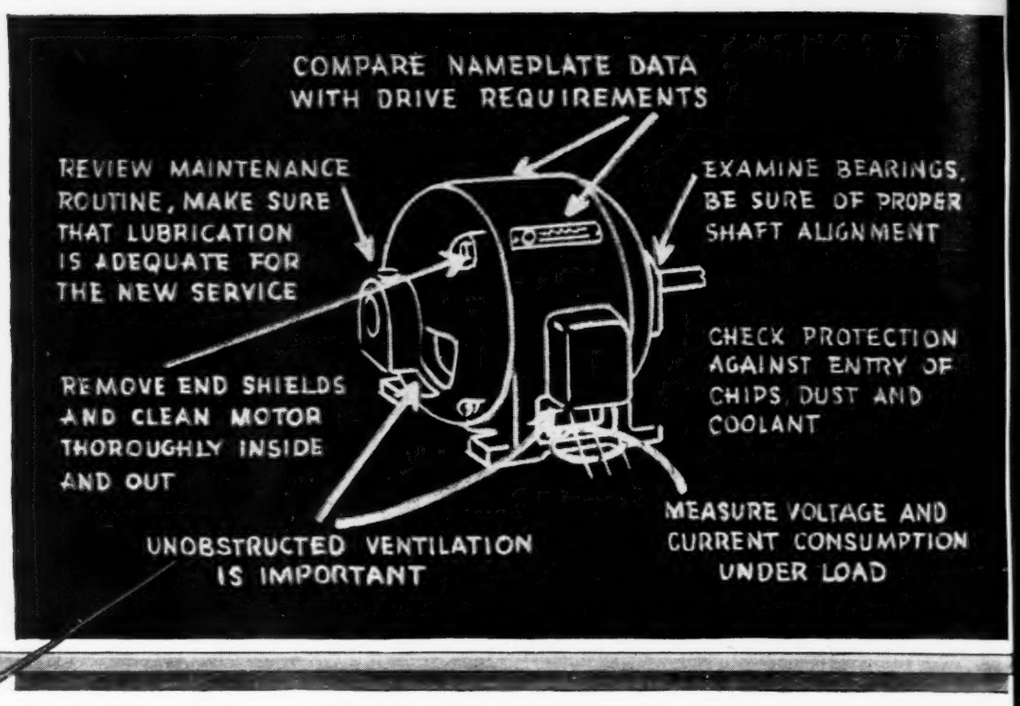
Standard Lubrication Engineers haven't all the answers, but they have helped many plants meet war-time loads. Examples of this service are briefly described at the left. See if they suggest ways one of these Engineers can help you. Then write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago, Illinois, for the Engineer nearest you. In Nebraska, write Standard Oil Company of Nebraska at Omaha.

STANDARD OIL STEAM CYLINDER OILS

STANDARD OIL COMPANY (INDIANA)

LUBRICATION ENGINEERING . . . LUBRICATION ENGINEERING . . . LUBRICATION ENGINEERING . . . LUBRICA

it's time to be a crank about


COMPARE NAMEPLATE DATA WITH DRIVE REQUIREMENTS
REVIEW MAINTENANCE ROUTINE, MAKE SURE THAT LUBRICATION IS ADEQUATE FOR THE NEW SERVICE
EXAMINE BEARINGS, BE SURE OF PROPER SHAFT ALIGNMENT
CHECK PROTECTION AGAINST ENTRY OF CHIPS DUST AND COOLANT
REMOVE END SHIELDS AND CLEAN MOTOR THOROUGHLY INSIDE AND OUT
UNOBSTRUCTED VENTILATION IS IMPORTANT
MEASURE VOLTAGE AND CURRENT CONSUMPTION UNDER LOAD

protect your production with this maintenance plan

Planned motor maintenance, keyed to today's loads and conditions, saves vital hours of production time by forestalling future breakdowns and delay. In replacing hit-or-miss motor servicing with a regular schedule of trouble-*prevention*, you'll find real help in "How to Care for Motors."

The check list (right) tells what to do. This book tells how to do it, using well-proved methods that save time and help assure long-lasting motor service.

And, of course, your local G-E Motor Representative is always ready to aid you in putting these suggestions into practice, or in getting the new motors you may need for essential wartime jobs.

General Electric, Sec. A750-150
Schenectady, N. Y.

Yes, send me a copy of "How to Care for Motors," GEA-2856A.

Name.....

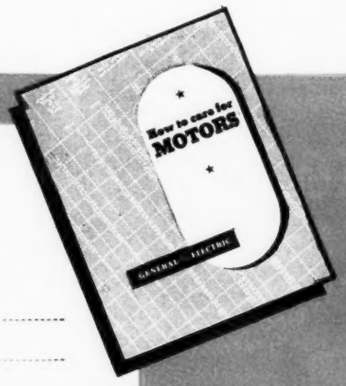
Title.....

Company.....

Address.....

City.....State.....

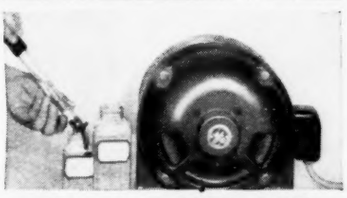
8030



HOW TO CARE FOR MOTORS

Every mine will find this book of value . . . it tells what to do to get the most out of motors, old or new. If you're setting up a maintenance program, or if you're "switching" motors from one job to another, or equipping machines with new motors, you'll find this bookful of helpful motor facts will save you time. Write for a copy.

MOTOR CARE



HERE'S WHAT TO DO!

1. Make sure that motors are selected to *match the job.* Install motors so they are properly aligned with the driven load and are easily accessible for regular inspection.

See "How to Care for Motors"

2. Keep motors free from dust and dirt. Establish a definite cleaning schedule.

See "How to Care for Motors"

3. Be sure that lubrication is frequent enough to take care of increased production. See that employees are instructed as to proper methods. Also guard against over-lubrication.

See "How to Care for Motors"

4. A general overhauling of hard-worked motors will add years to their life. If your motors haven't had an overhaul in the last year, try to arrange your production schedule to permit one as soon as possible.

See "How to Care for Motors"

If you need new motors for important war work, check with your G-E Motor Representative on how to get Tri-Clad motors quickly.

The Navy "E", for Excellence, has been awarded to 92,780 General Electric employees in six plants manufacturing naval equipment.

BUILDER OF

TRI-CLAD MOTORS

REG. U.S. PAT. OFF.

GENERAL ELECTRIC

★
Award for Excellence
★

ARMY-NAVY PRODUCTION AWARD

for high achievement in the production of war equipment

conferred upon the

LINCOLN ENGINEERING COMPANY

We are proud to announce that we have been awarded the Army and Navy "E"—the coveted emblem conferred by the United States Army and Navy for high achievement in the production of war equipment.

This achievement has resulted from the combined efforts of every man and woman in the employ of the Lincoln Engineering Company. The "E" pin which each person in our organization wears, and the "E" pennant that flies over the Lincoln plant serve as silent inspiration toward greater and greater accomplishment until the time of final and complete Victory.

★

LINCOLN ENGINEERING COMPANY, ST. LOUIS, MO., U. S. A.

Pioneer Builders of Engineered Lubricating Equipment

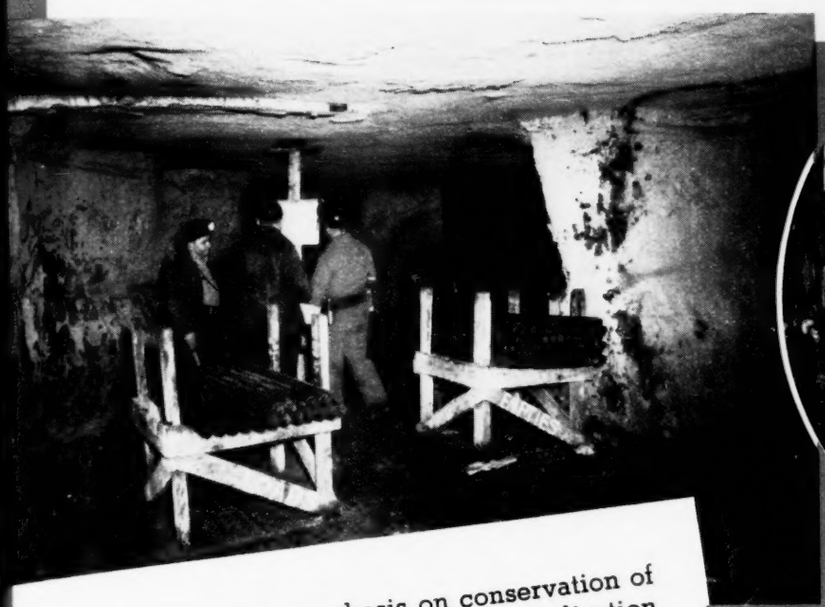
42-100

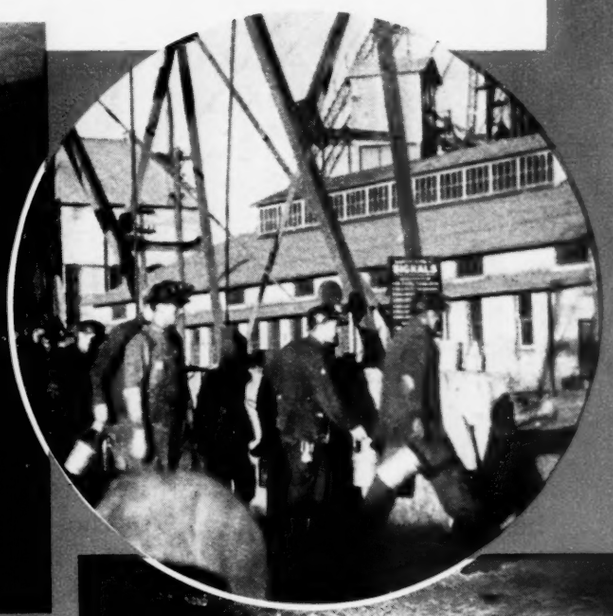
CARDOX

"THE NON-EXPLOSIVE MINING METHOD"

HELPS YOU MOBILIZE

Available Men and Machines For Maximum War Production





★ With war-time emphasis on conservation of critical materials . . . as well as efficient utilization of diminishing manpower and peak production . . . the advantages of the Cardox Non-Explosive Mining Method have taken on added significance.

As CARDOX produces no smoke or noxious fumes, available men and machines can produce more tonnage on each shift. By rolling out the coal for easier loading, CARDOX reduces wear and tear on mechanical loaders . . . keeps them on the job and out of the repair shop.

Ask for a demonstration of these CARDOX advantages in your own mine.

CARDOX CORPORATION

BELL BUILDING • CHICAGO

WRITE OR WIRE FOR DESCRIPTIVE BROCHURE AND DETAILS OF FREE DEMONSTRATION AT YOUR MINE

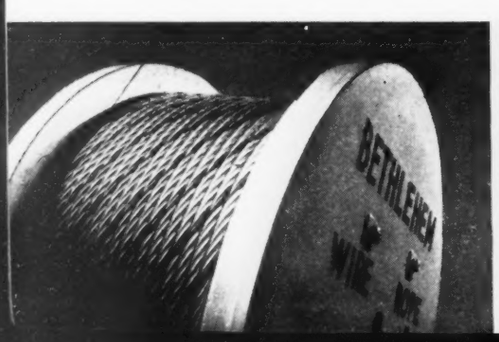
"I'll bet he co

The two mine operators couldn't understand it. So far this year, they both were turning out a higher average tonnage than ever before, with some days very good and some not so good. But Bill Riggs, over there! Day in, day out, his tonnage figures were consistently high. He never seemed to have an off day. Never seemed to run into the headaches they had at every turn. Was it luck, they wondered?

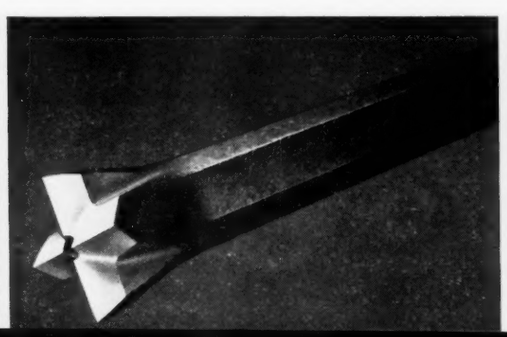
Perhaps it was more than a horseshoe. Perhaps his record was due to the extra care he took at every turn to prevent those small but costly breakdowns and stoppages. It might have been, for instance, due partly to his choice of Bethlehem equipment.

Bethlehem mine equipment helps prevent breakdowns and promotes efficient operation because it is built with an extra margin of safety. Look at the four Bethlehem products featured below. Note how the sturdy construction of each makes it better able to stand up to today's forced-draft mine operation.

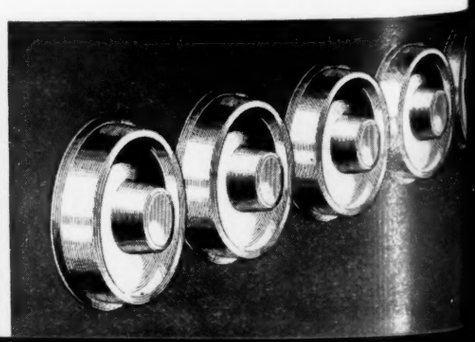
Bethlehem's Form-Set Preformed Wire Rope resists kinks, is easier to handle, and thus cuts down delays. As you can imagine, these qualities are doubly valuable when you are working in the cramped quarters of a 3-ft. ceiling. Form-Set Wire Rope can also be installed easier and in a shorter time because of its flexibility and relaxed condition. It has longer resistance to bending fatigue and does not "porcupine", thus avoiding injury to worker's hands.



More inches of hole per minute can be drilled with Bethlehem's Superior Hollow Drill Steel. That's the record of many a job with this remarkable drill steel. Bethlehem Superior outperforms others because it is made of a special fatigue-resisting steel, tough, and pretested to insure uniform response to heat-treating. In addition, the hole is accurately centered and tests show it is free from the pits and cracks that ordinarily cause fatigue failures.



Bethlehem's Forged Steel Mine Car Wheel has never failed! Ever since 1927 when introduced, not one flange or tread has ever cracked, chipped, or broken in service. No wonder many progressive mine operators using these wheels have cut their wheel failure losses to zero. Bethlehem Wheels perform like this because they are made of a grade of highly-uniform open-hearth steel and are thoroughly forged for greater strength, toughness, and resilience.

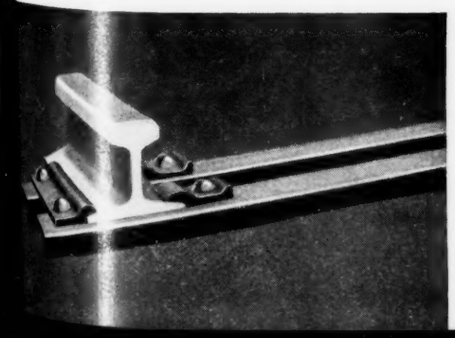


carries a dozen horseshoes!"

"I rely on more than a horseshoe for my Victory tonnages . . . I rely on this Bethlehem equipment!"

Rails . . . Steel Ties . . . Frogs, Switches, Switch Stands, Turnouts, and Special Trackwork, Track Bolts, Nuts and Spikes . . . Mine Cars, Wheels, Axles . . . Bars, Plates, Structural Shapes . . . Steel Construction . . . Steel Timbering . . . Pipe, Boiler Tubes . . . Galvanized Roofing, Siding . . . Wire Rope, Strand . . . Drill Steel

Experience shows that Bethlehem Steel Ties last longer, provide faster installation. When portable track sections of 4, 6, 8, or more feet are needed for tunnel work, they can be built up in a few minutes with these sturdy Bethlehem Steel Ties. These ties have riveted clips that lock the rails rigidly in place and provide permanent gaging for the track. A hammer blow on each clip does the job. Dismantling is just as quick. These ties have been relaid in some mines as many as 40 times.



BETHLEHEM STEEL

Strip Coal Mines Equipped with WALTER TRACTOR TRUCKS had a Head-start on the War Emergency!

LONG before the war emergency, mines using WALTER Tractor Trucks had the answer to today's two big problems: First, producing greater tonnage and second, keeping hauling equipment on the job —avoiding breakdowns under extra-shift operation. The tremendous power-plus-traction of Walter 4-Point Positive Drive permits hauls up to 55 ton payloads in any weather, any running conditions, on any grades. WALTER Tractor Trucks are built like a battleship — specially engineered and constructed throughout for gruelling service. They keep going day after day, under conditions that stop anything else on wheels. Write for literature and learn more about WALTER Tractor Trucks.

FEATURES OF WALTER TRACTOR TRUCKS

- **AUTOMATIC LOCK DIFFERENTIALS** proportion the torque to each wheel according to its requirements at any instant.
- **SUSPENDED DOUBLE REDUCTION DRIVE** reduces unsprung weight, gives higher ground clearance, saves wear and tear on truck and tires.
- **SCIENTIFICALLY CORRECT WEIGHT DISTRIBUTION** with engine forward, short wheelbase, easy maneuvering.
- **TRACTOR TYPE TRANSMISSION,** 14 to 1 range, with 6 speeds forward, 2 reverse, fast high gear, powerful low gear Powerful diesel or gasoline motors.

WALTER MOTOR TRUCK CO.

1001-19 Irving Ave., Ridgewood, Queens, L. I., N. Y.

PARTS AND SERVICE FOR WALTER TRUCKS

Consult your local Walter distributor for expert repair service and genuine parts to keep your Walter Trucks in top running condition.

Picking and Choosing. With workmen getting scarcer all the time, finding good men for battery maintenance is getting ever more difficult. All batteries, of course, deserve good maintenance—but it is easier to train new men in the proper maintenance of alkaline batteries, and there is much less risk and trouble while they're learning. Charging in the wrong direction or failing to terminate the charge at the exact moment are common examples of the electrical "accidents" that cause no permanent injury in alkaline batteries.

For the Duration. Hand-to-mouth buying of equipment has gone by the boards, because this looks as though it will be a l-o-n-g war. Consequently, equipment which will last for the duration and be economical after the war is over is much the the most desirable. Edison Alkaline Batteries have shown that they last two to five times longer than other batteries . . . so naturally, they are that much more likely to see the critical period through.

Faster Charging Rate. More mechanization is speeding up the production, but it is also putting new drains on the power lines. The faster charging rates which can be accepted by Edison Alkaline Batteries present two distinct advantages: (1) the batteries can be hustled back to the job more quickly, *fully charged;* and (2) if the off-peak charging time has, through increased shifts, been cut down, alkaline batteries can accommodate themselves better to the new conditions.

Edison Storage Battery Division
Thomas A. Edison, Inc.
WEST ORANGE, N. J.

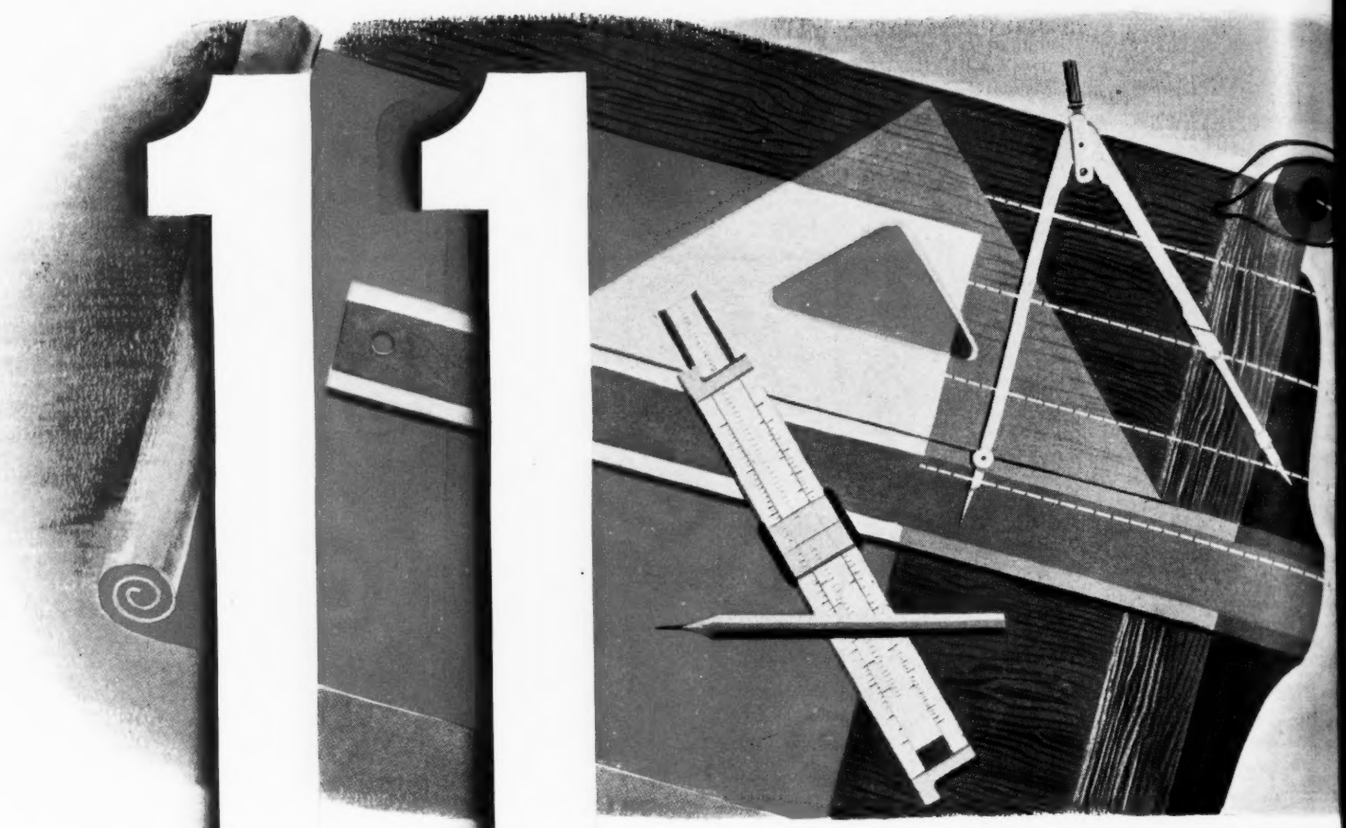
THIS POWER is predictable

Underground haulage can be the most costly item in the whole war production scheme—because the cost is determined not alone in dollars, not alone in time—but in production itself. When the filled cars come through, we are winning the war. When they stop, we are losing it! All of which is another way of saying that the power units which you use underground must be predictable if the production flow is to be kept even. There is no way of making up lost time, but there is a way of forestalling lost time—and that is the use of Edison Alkaline Batteries. It is a fact recognized throughout mining, industry and railroading that there is no battery which gives such uninterrupted operation—and a performance that is so fully predictable. Yes

MINING NEEDS THE RELIABILITY OF

Edison Alkaline BATTERIES

11 years' Engineering Progress resulting in . .



11 IMPROVEMENTS

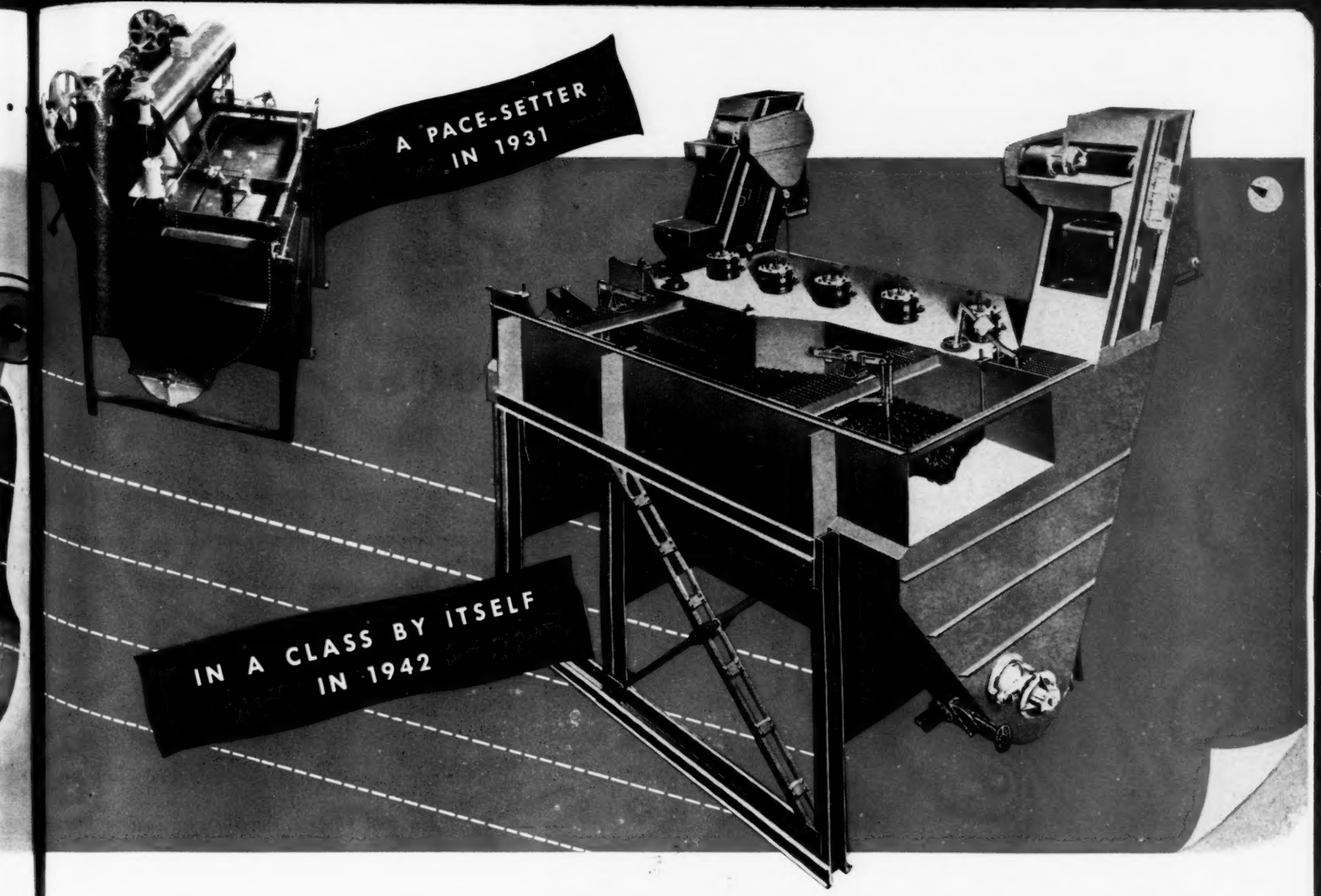
in McNally-Norton Washer

In July, 1931, McNally Pittsburg acquired the manufacturing rights of the Norton Automatic (Baum Type) Washer. Already this efficient system, through six years of development, had become outstanding in England. First, by patented, pneumatically operated, non-clogging undercut ejection gates. Second, by patented automatic cessation and resumption of washing impulse for momentary interruptions of feed. Third, by integral construction of reject elevators with the washer. Fourth, by streamlined construction of the washing compartments. Fifth, by patented principle of the lowered air chest.

All of these advantageous features are still to be found in the McNally-Norton Automatic Washer as manufactured today *PLUS 11 additional improvements* as developed over 11 years of research to make the McNally-Norton Washer rank as one of our top pieces of equipment to make coal a better fuel. These improvements are briefly listed on the following page. McNALLY PITTSBURG MFG. CORP., Main Office and Works, Pittsburg, Kansas; General Sales Office, 307 N. Michigan Avenue, Chicago; Eastern Office, Koppers Bldg., Pittsburgh, Pa.

THESE IMPROVEMENTS OFFER YOU . . .

- ✓ **Positive separation of coal and refuse**
- ✓ **Simplified and speedier finger-tip operating control**
- ✓ **Unobstructed accessibility for inspection and renewal of parts**
- ✓ **Greatly lowered cost and time out for maintenance**



1. **General mechanical improvements** have been made to simplify manufacture and improve operating characteristics. Welded construction is used instead of riveting, providing a more rigid assembly with less weight. Gate-operating cylinders were revised and relocated for more rigid mounting, better accessibility, and improved appearance. A new inclined partition plate and baffle was placed in the refuse well, greatly improving delivery to the refuse elevators and reducing wear on the buckets. Evacuating gate supports were redesigned, improving both manufacture and operation.

2. **Rejection orifice depth and inter-compartment overflow weir** have been made externally adjustable and redesigned to eliminate restriction to the concentrate bed.

3. **Manhole entry into each washing cell** has eliminated necessity of removing screen plates for inspection or repair of mechanism located below the plates. This permits tack-welding of screen plates to supporting bars instead of former bolting down practice.

4. **Proper distribution of feed to the washer** has been satisfactorily solved by the development of duplex trapezoidal feed sluices.

5. **Transverse distribution of impulse intensity**, particularly in the larger washers, has required intensive study. Now, control baffles for each washing cell, externally adjustable, permit control of impulse intensity across full width of the washer.

6. **The control float and supporting gear with relay valve** have been improved from time to time, each improvement resulting in more accurate control of the evacuating gate and increased sensitivity.

7. **Continuous evacuation of rejects,** at varying rates controlled by the float, has been effected by redesign of the float, its supporting gear and relay valve. Increased accuracy of control and sensitivity of adjustment have resulted. At each impulse cycle, relatively small increments of compressed air are added to or withdrawn from the gate-operating cylinder through the relay valve. The position of the undercut gate is readjusted at intervals of approximately 1½ seconds to exactly conform to the rate of delivery of sink material in the washer feed.

8. **Relocation of the air receiver** from the former position above the top deck to below the deck not only affords clear passageway across the deck, but much more important is the increased range and sensitivity of control of the impulse characteristics.

9. **Individual drives for reject elevators** have been another major improvement. Change of speed of either elevator is easily made by a simple change of sprockets on the driving gear-motor, and, if design requires, either elevator may be extended to deliver at a higher elevation.

10. **The patented compound washer** is a recent development. It is a standard washer of any desired size and number of cells, with which is incorporated a smaller unit for rewashing the secondary rejects or middlings, with or without crushing. Both units have common supports and common air supply but completely independent adjustments.

11. **Simple adjustment features** have been the aim of our engineers over these many years of improvements. *All operating adjustments may be made while the washer is in operation.* Settings of water inlet valves, rejection orifices, transverse distribution baffles, and primary-secondary division plate are measurable directly by rod extensions. Float submergence and its compensation, bed depth, and float gravity read directly on calibrated scales. Air inlet valves settings are indicated on a ruled quadrant. Air and water pressures are indicated by gauges. For coal operators who desire a more detailed description of the eleven improvements, a technical memo has been prepared. It will be mailed without obligation to those who request it.

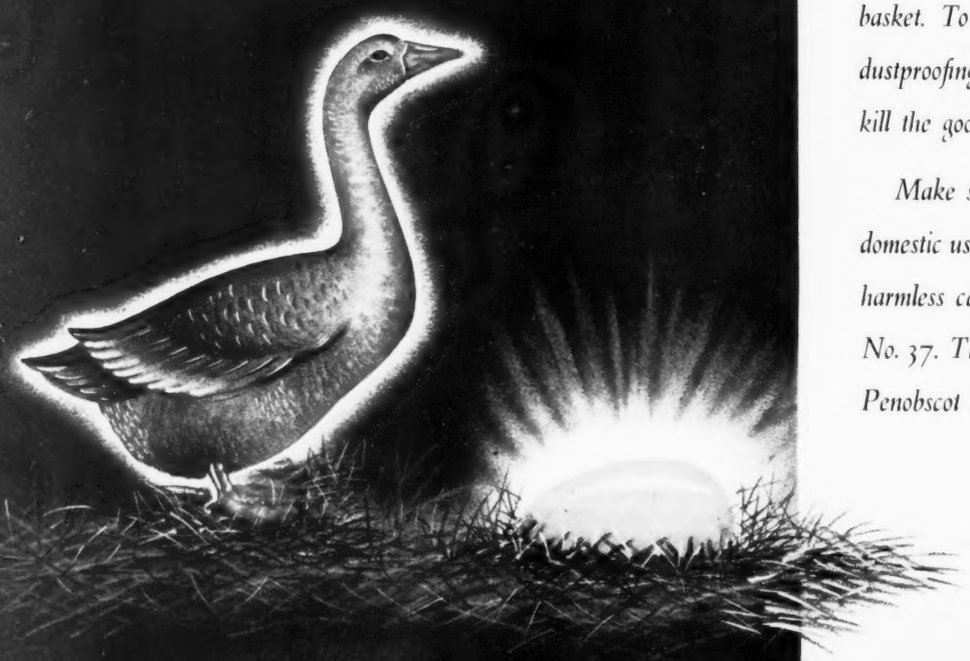
McNALLY PITTSBURG

MANUFACTURERS OF EQUIPMENT TO MAKE COAL A BETTER FUEL

Main Office and Works
Pittsburg, Kansas
General Sales Office
307 N. Michigan Ave., Chicago
Eastern Office
Koppers Bldg., Pittsburgh, Pa.

DON'T KILL THE GOOSE

that lays the golden eggs . . .



Government restrictions on the use of oil and gas have given the coal industry thousands of new customers—have brought back thousands of old coal users who had changed to other fuels.

The coal industry must face the fact, however, that the present conversion is a wartime necessity—not a voluntary influx of new customers. To retain these new coal buyers after the war, coal must become their preferred fuel, used because they like it, not because they are forced to buy it.

Clean dustless coal, as convenient and satisfactory as other fuels, will keep the golden eggs in your basket. To lower standards of preparation—to stop dustproofing or do an inadequate job might well kill the goose that lays these golden eggs.

Make sure therefore that every ton of coal for domestic use is adequately dustproofed with effective harmless calcium chloride. Write for new bulletin No. 37. The Calcium Chloride Association, 4145 Penobscot Building, Detroit, Michigan.

To "UP" your Production . . . Select from 19 Atlas Permissibles

Production must be kept up. But no two mines are alike, and seams may differ even in the same mine.

To meet these problems, Atlas supplies 19 Permissibles—each with its own advantages.

Important properties are—

1 ***Weight strength:*** amount of energy released by a given weight explosive.

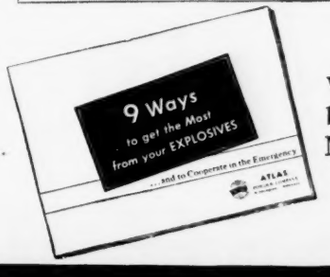
2 ***Velocity:*** speed with which the explosive changes from a solid to a gas.

3 ***Density:*** number of cartridges in a given weight of explosive.

From these 19 Atlas Permissibles—at work today getting out coal more efficiently—select the ones that best fit your requirements. Ask the Atlas representative to tell you more about them.

Coalite	Weight Strength	Velocity, feet per second, in the open 1¼" x 8"	Minimum Number 8" cartridges per 50 pounds (Max. 5% more) 1¼"	1½"	2"
B	60	9,700	160	111	61
C	60	10,000	133	96	53
E	55	6,000	133	96	53
G	60	7,750	145	102	57
K	60	7,250	220	150	85
L	60	7,500	200	137	76
LS	60	5,000	210	144	81
M	60	8,000	180	123	70
M-1*	60	8,000	180	123	70
O	55	6,000	244	166	93
S	60	7,500	160	111	61
T	60	6,000	160	111	61
T-1*	60	5,500	170	117	66
T-2*	60	6,000	160	111	61
Apcol #1	60	5,000	133	96	53
Gelcoalite #3	55	5,900	120	82	46
Gelcoalite W	55	12,000	120	82	46
X	35	8,200	97	65	38
Z	55	16,400	107	73	41

*Available in sprayed (not redipped) shells which have appreciably better smoke ratings.



Write for your copy of the booklet "9 Ways to Get the Most from Your Explosives."

COALITE, APCOL—Reg. U. S. Pat. Off.

ATLAS EXPLOSIVES *"Everything for Blasting"*

CHEMICALS ATLAS EXPLOSIVES

ATLAS POWDER COMPANY, Wilmington, Del. · Offices in principal cities · Cable Address—Atpowco

Coal is fuel and fuel produces steel. Coal makes steam and steam generates power.

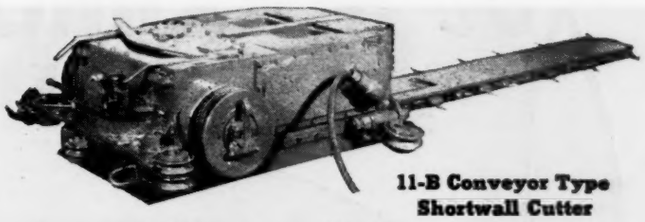
Uncle Sam needs more steel and more power to win this war.

SPEEDY SULLIVAN COAL CUTTERS FOR EVERY MINING METHOD

• As every mine operator knows, only with more steel and more power can we manufacture enough planes, tanks, ships and guns to beat the Axis. And only with more coal produced faster can we get enough steel and power.

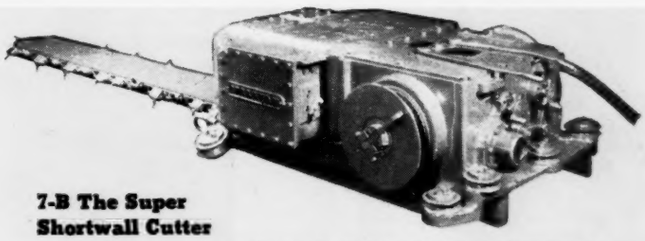
That is why operators are turning to Sullivan Coal Cutters, because Sullivan Cutters mean more coal mined faster. They are so fast they easily stay ahead of loader or conveyor. They are so economical that even if you have to use a bigger drilling and tamping crew to keep up with them, your costs will shrink.

Ask a Sullivan representative for proof that Sullivan Coal Cutters not only are fast and economical but are the easiest to operate, the easiest to keep "underground," and *stay there* longest. SULLIVAN MACHINERY COMPANY, *Executive Offices:* Michigan City, Ind. *Associated House:* Canadian Sullivan Machinery Co., Ltd., Dundas, Ontario.



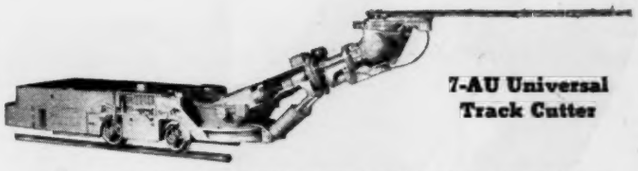
11-B Conveyor Type Shortwall Cutter

Lowest cutter in its power range which delivers cuttings to rear. Cuts a 6-inch kerf. A tough little cutter that's speedy in operation, easy to move around and position. Fool proof and convenient operation. Simple controls handled at rear or side. Rugged, accessible construction. Splash lubrication. Anti-friction bearings, alloy steel gears and pinions. Big-load-starting motor. 20, 35 or 50 h. p.



7-B The Super Shortwall Cutter

A fast cutter that stays well ahead of the loader. For modern mechanized mining. Handles a 9-foot bar. Two-direction operation. Variable feed control for hard cutting or worn bits. Easy to handle. Durable—has splash lubrication, alloy steel gears and pinions, 50 h. p. slow speed motor. Superior, through and through construction makes 7-B stay underground longer. All parts easily accessible.



7-AU Universal Track Cutter

50% longer reach, the fastest and most flexible cutter. Cuts anywhere between roof and floor of seam. Cuts top, center or bottom. Shears rib, center or angle. Cuts and shears slabs. Has bar tilt and roll. The only cutter that can drive a 21 foot room with ribs parallel to track. Cuts wider rooms for greater tonnage per cut. Complete control from either side of machine.

Sullivan 7-AU is licensed under patents to E. C. Morgan, patents numbers 170691—170692—1707132—1953325—1953326

SULLIVAN

The Coal Cutter Specialists

Coal Mining Machines • Scraper Haulers • Rock Loaders • Hoists
Car Pullers • Air Compressors • Rock Drills • Cutter Bit Sharpeners and Heaters • Core Drills and Core Drill Contracting

Sales offices in:
Birmingham, Ala.
Butte, Mont.
Chicago, Ill.
Dallas, Texas
Denver, Colo.
El Paso, Texas
Huntington, W. Va.
Knoxville, Tenn.
Middlesboro, Ky.
New York, N. Y.
Pittsburgh, Pa.
San Diego, Calif.
San Francisco, Calif.
Salt Lake City, Utah
Scranton, Pa.
St. Louis, Mo.
Johannesburg, So. Africa
Sydney, Australia
Grantham Lincs, England

for MAXIMUM CAPACITY IN MINIMUM SPACE

Interchangeable

WITH SINGLE-ROW BALL BEARINGS

NORMA-HOFFMANN

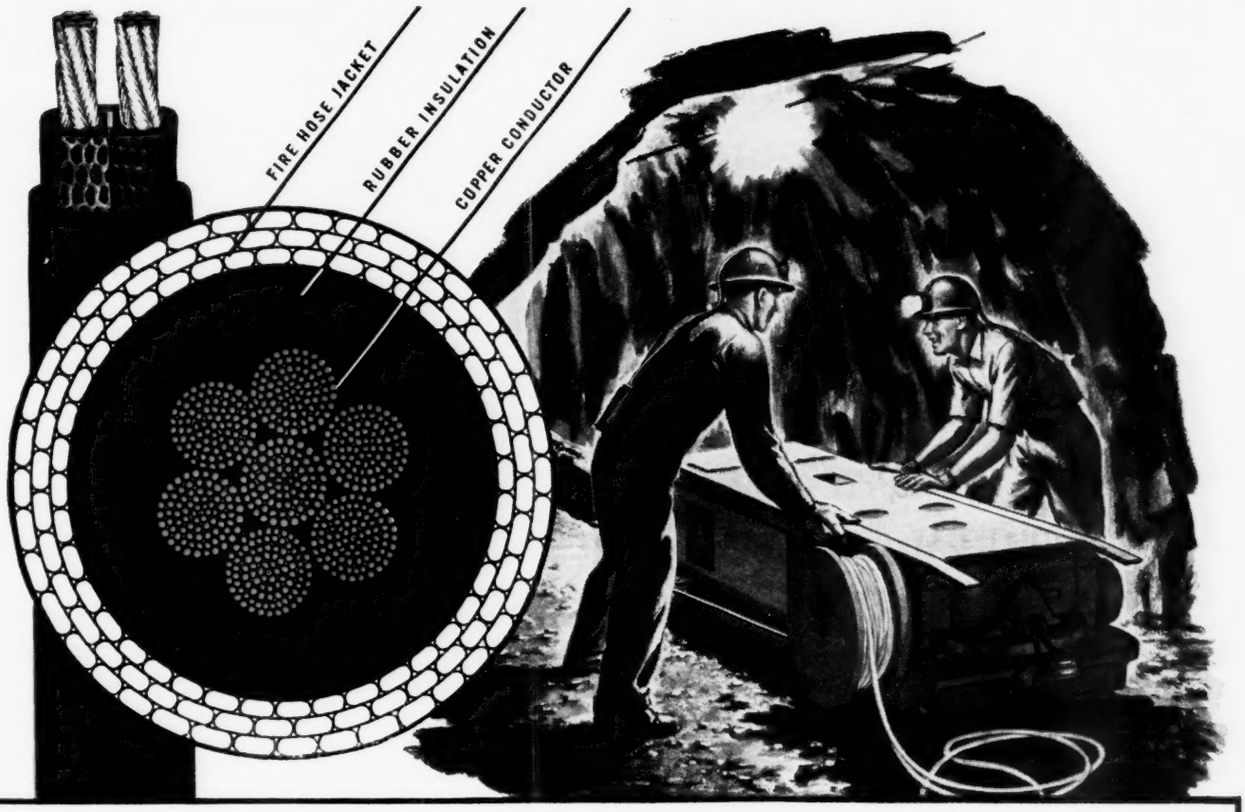
PRECISION ROLLER BEARINGS

NORMA-HOFFMANN BEARINGS CORP'N.,

STAMFORD, CONN., U. S. A. • *Founded in 1911.*

Write for the Catalog. Let our engineers work with you.

Their solid cylindrical rollers provide maximum contact area, giving larger load and shock-absorbing capacity than any other single-row bearing of like dimensions. Thus, when NORMA-HOFFMANN PRECISION ROLLER BEARINGS are used in place of ball bearings, a greater factor of safety is provided, together with added life, particularly under vibration and overload. PRECISION qualities in workmanship and materials adapt them alike for both low and high speeds.



Duracord saves up to 50% rubber in portable cables...has a better than 20-year service record

THERE is nothing "ersatz" about Duracord*; it is a cable construction developed during the last war to meet the need for heavy-duty cords and cables . . . a need it is *currently* filling not only in mines but also industrial plants and shipyards.

The Duracord covering is woven like a fine hose—*not braided.* This tough yet flexible cover replaces the rubber jacket on all-rubber cords making possible rubber savings as high as 50%.

For further information, please send us your inquiries.

SUNEX SECURITYFLEX* TO WAR

This well-known all-rubber companion to Duracord has been preempted for the toughest kind of jobs in the war effort where all-rubber cord is mandatory. Until peace, its use will be strictly regulated. 42255

*Reg. U.S. Pat. Off.

Two marks of achievement – the cherished Navy "E" (awarded to two of our plants) for achievement in production...The Anaconda trade-mark for achievement in quality.

ANACONDA WIRE & CABLE COMPANY

Subsidiary of Anaconda Copper Mining Co.

General Offices: 25 Broadway, New York

Chicago Office: 20 North Wacker Drive

Sales Offices in Principal Cities

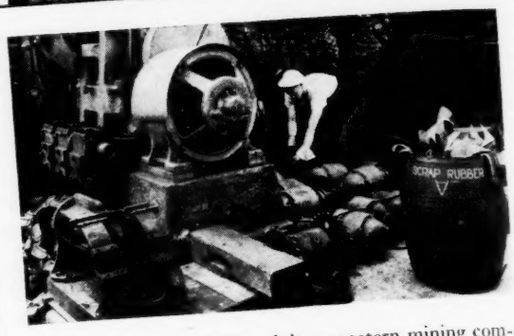
Sunex Securityflex and Duracord

ANACONDA WIRE & CABLE COMPANY

NEWS from the scrap front

TIPS FROM OTHER "WASTE WARDENS" THAT MAY HELP YOU DO A BETTER JOB OF "GETTING IN THE SCRAP"

★ ★ ★



RECLAIM! RE-USE! SCRAP!—A large eastern mining company salvages old equipment three ways. If it can be modernized, it is rebuilt, and wornout parts are scrapped. If it is no longer needed "at home" but can be used elsewhere in war work, it is sold. If it can't be rebuilt or re-used, it is scrapped at once. . . . *Does your salvage system include all three?*

OLD AXLES MAKE NEW SHAFTS—A Pennsylvania mining company gets top salvage value out of its broken locomotive axles by machining them down to make replacement shafts for motors and generators. The turnings make excellent scrap. . . . *Are you using salvaged material to help you solve your parts replacement problems?*

SHIPBUILDER KEEPS SCRAP ON THE MOVE—Every week about 100 tons of steel scrap is returned to mills by an inland shipyard that builds patrol boats for the Navy. No dump is allowed to accumulate. About 75% of the salvaged material is heavy structural steel and plate cuttings, 15% is miscellaneous, and 10% is machinings. . . . *Are you shipping your scrap promptly and continuously?*

THE SCRAP IS COMING IN...*but not fast enough!*

We have the proof that industry is cooperating in the drive for scrap metals . . . proof measured in thousands of tons. But mills must get *more* iron and steel scrap if they are to meet the gigantic needs of war industry.

Don't forget . . . steel gets to work on the battlefront more quickly when plenty of scrap is available. Scrap is already metallic. Therefore, less ore needs to be converted into pig iron per ton of steel produced. By remelting scrap to make new steel, more tons of high-quality products can be turned out in a hurry for war purposes.

So make it your personal war assignment to see that your organization does a thorough, continuous job of "getting in the scrap." Cooperate closely with your local Salvage Committee. This is one drive that must not fail!

UNITED STATES

NEBRASKA HITS THE JACKPOT—To stimulate scrap collection throughout Nebraska an Omaha newspaper sponsored a $2000 contest. Results were amazing. 135 million pounds of scrap was turned in—about 103 pounds per capita—setting a new pace for the nation. . . . *Have you tried an incentive system to step up scrap collection in your company? In your community?*

"PAINLESS EXTRACTION" OF CAR RAILS—This new rail remover can pull up 4000 lineal feet of rail a day, its designers say. Besides speeding the salvage job, it reduces damage to pavement and simplifies repaving. 60,000 tons of rail in New Jersey alone will soon be removed with this type of machine. . . . *Is your community equipped to salvage rails economically?*

VETERAN WEAPONS DRAFTED AGAIN—This old Gatling gun and German "dud" torpedo from World War I turned up in a mid-western scrap drive. When they were cut up in the scrap yard, the torpedo yielded over 1000 pounds of steel and the gun about 500 pounds of brass and steel. . . . *Do you know of any war relics, of little historic value, which should be scrapped?*

WE "PRACTICE WHAT WE PREACH"—In one of many salvage operations, a U. S. Steel subsidiary recently dismantled for scrap several of its own mill buildings no longer suited to present practices. The yield was 3500 tons of steel scrap. . . . *Do you have any steel structures, idle now and of doubtful future value, which should be scrapped?*

SEGREGATION

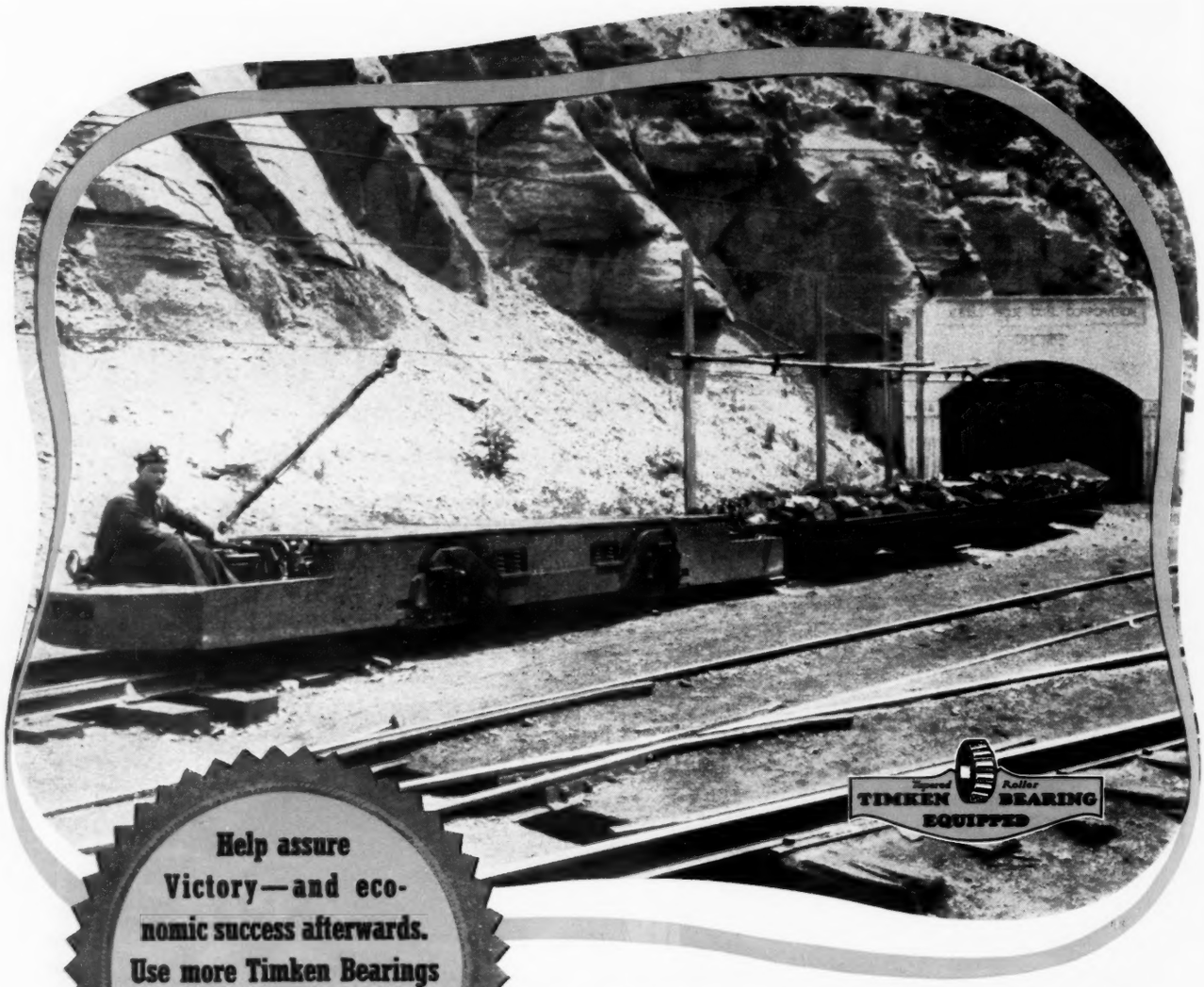
is increasingly important!

Wherever possible, sell your scrap in lots that have been carefully segregated, classified and labeled according to their type and metallic make-up. By making it easy for steel mills to identify accurately the alloy content of your machinings and other scrap, you help to speed production of NE Steels and make possible full utilization of critical alloys your scrap contains. Segregated scrap will bring you a better price, too.

USS

AMERICAN STEEL & WIRE COMPANY, *Cleveland, Chicago and New York* · CARNEGIE-ILLINOIS STEEL CORPORATION, *Pittsburgh and Chicago* · COLUMBIA STEEL COMPANY, *San Francisco* · NATIONAL TUBE COMPANY, *Pittsburgh* · TENNESSEE COAL, IRON & RAILROAD COMPANY, *Birmingham*

STEEL



Help assure Victory—and economic success afterwards. Use more Timken Bearings in all kinds of mining equipment. Redesign now.

TO ASSURE VICTORY
BUY UNITED STATES WAR SAVINGS BONDS & STAMPS

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS

Manufacturers of Timken Tapered Roller Bearings for automobiles, motor trucks, railroad cars and locomotives and all kinds of industrial machinery; Timken Alloy Steels and Carbon and Alloy Seamless Tubing; and Timken Rock Bits.

Coal mine operators using a preponderance of Timken Bearing Equipped mine cars have no transportation bottlenecks to slow up production. With locomotives hauling heavier trains at higher average speeds they can move more tonnage per shift from mine to tipple.

Furthermore, they are not bothered with lubrication problems, while cars spend more time in service — less time in the repair shop.

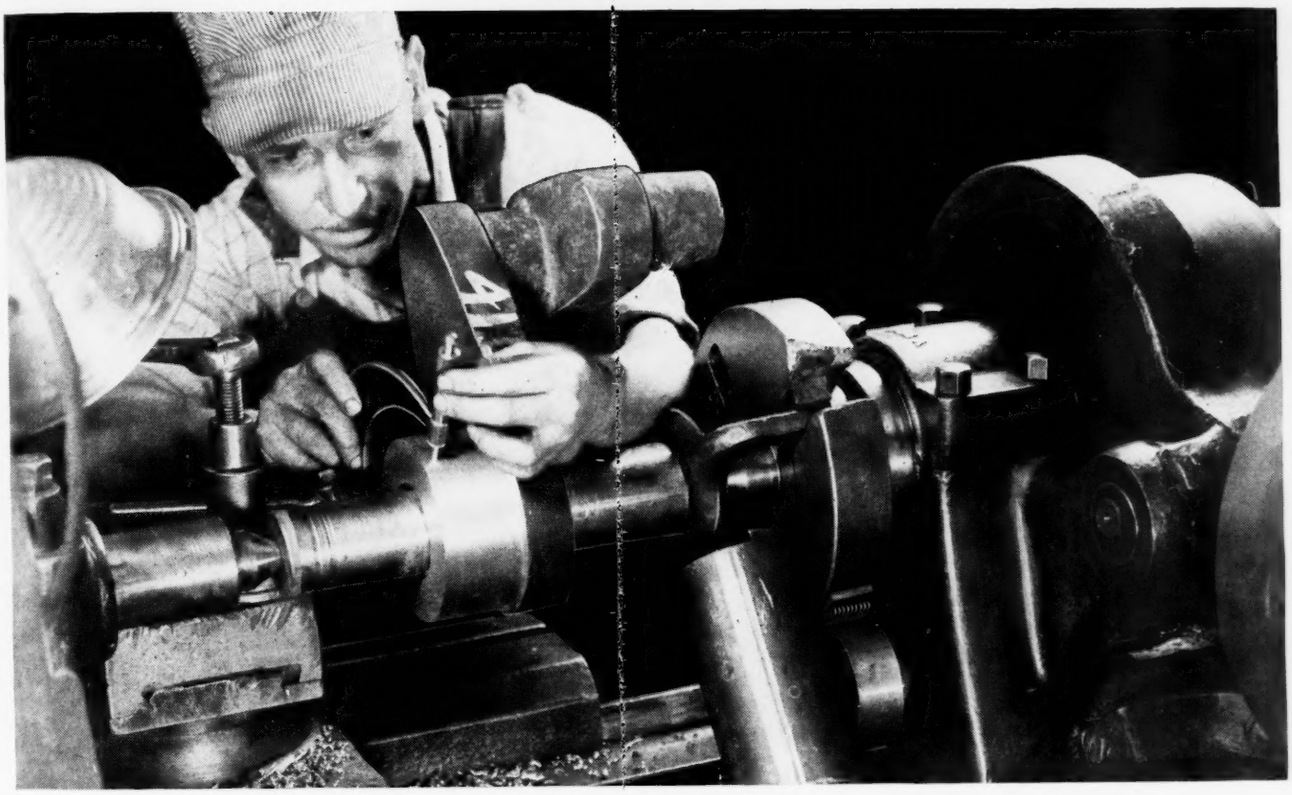
The Jewell Ridge Coal Corporation, Jewell Ridge, Va., knows it pays to operate modern mechanized equipment and is demonstrating it every day. This prominent operator has 1,300 of the latest type Timken Bearing Equipped mine cars in service and is receiving the utmost satisfaction from them.

Some of these cars are shown in the photograph, taken at their No. 2 mine located in Buchannon County, Va. This picture also shows one of the latest developments in Timken Bearing Equipped mine locomotives. This unusually low type haulage unit was designed especially for Jewell Ridge by General Electric and is equipped with Timken Bearings on all axles. There are two of these locomotives in service and a third on order.

Over 400,000 mine cars have gone into service on Timken Bearings during the last 21 years.

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO

Sure!—Anybody Can Make an Ordinary Crank



—but the crank shown above isn't made by just anybody. Like the hundreds of other parts that go to make up the Whaley "Automat", this crank is under the complete supervision of our own engineers from start to finish. We look at building our machines this way. We've been building heavy duty loading machines *exclusively* for over 35 years . . . all of our eggs in one basket . . . our machines *must* be right. The manufacture of every part in our own plant, under full control of our own engineers, is our guarantee of insuring the performance demands we set for the "Automat".

By performance demands we mean just this. The Whaley "Automat" is built to load coal, but, it is also built to withstand the strain and punishment of heavy rock work incidental to coal mining. Such a combination can't be beat for low maintenance in any coal mine.

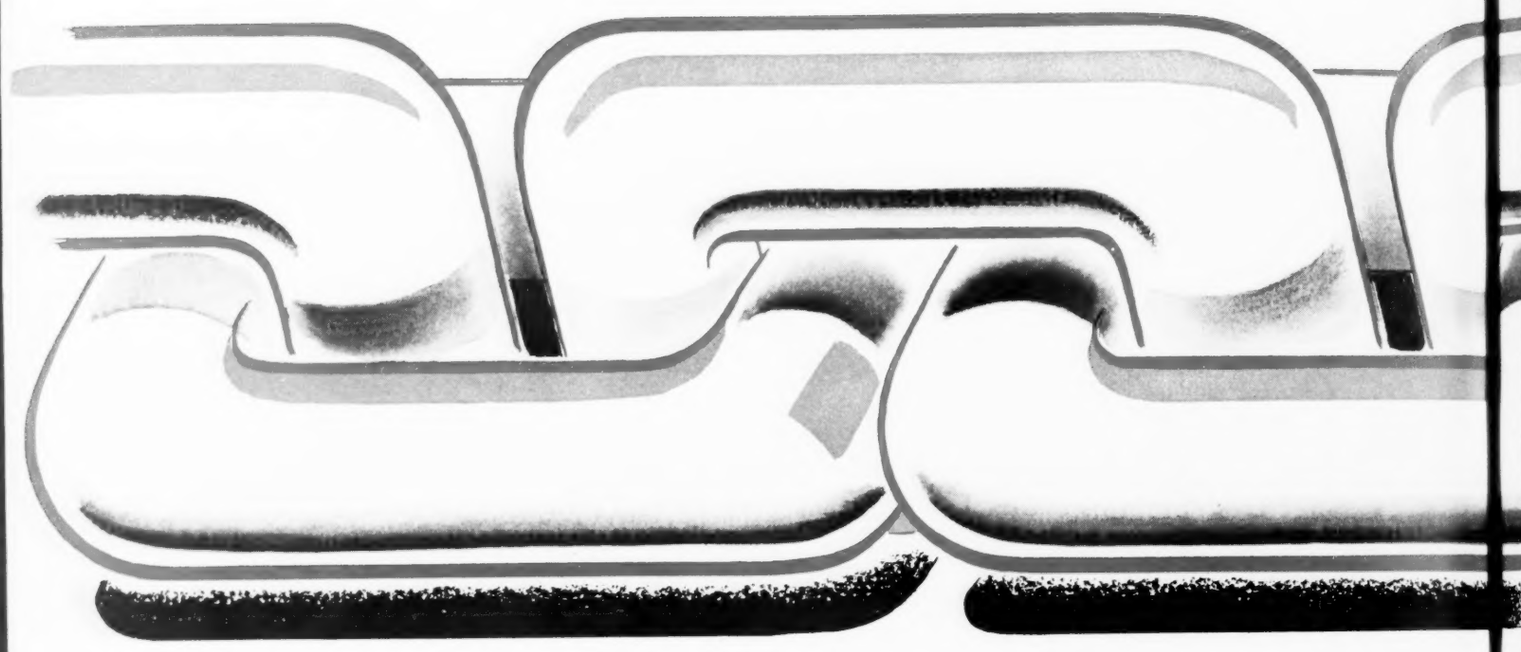
Throughout the coal industry, the "Automat" is recognized as the only loader available that will stand up equally as well under the strain of rock work as it does in loading coal. This reputation has been earned first, because of the Automat's shovel action method of operation. Second, because of rigid construction supervision and the making of every single part to so do its job perfectly.

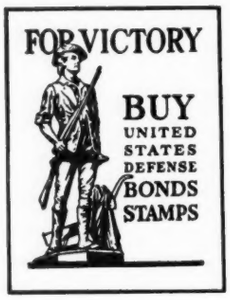
Because of the easy shovel action, only one 25 H.P. motor is required to operate the "Automat" for maximum loading capacity. Power of only $\frac{1}{5}$ KWH per ton of material loaded is required. This vertical shovel action is responsible also, for the "Automat" being the safest loader known. No side thrusts, no knocking out of timbers in close places.

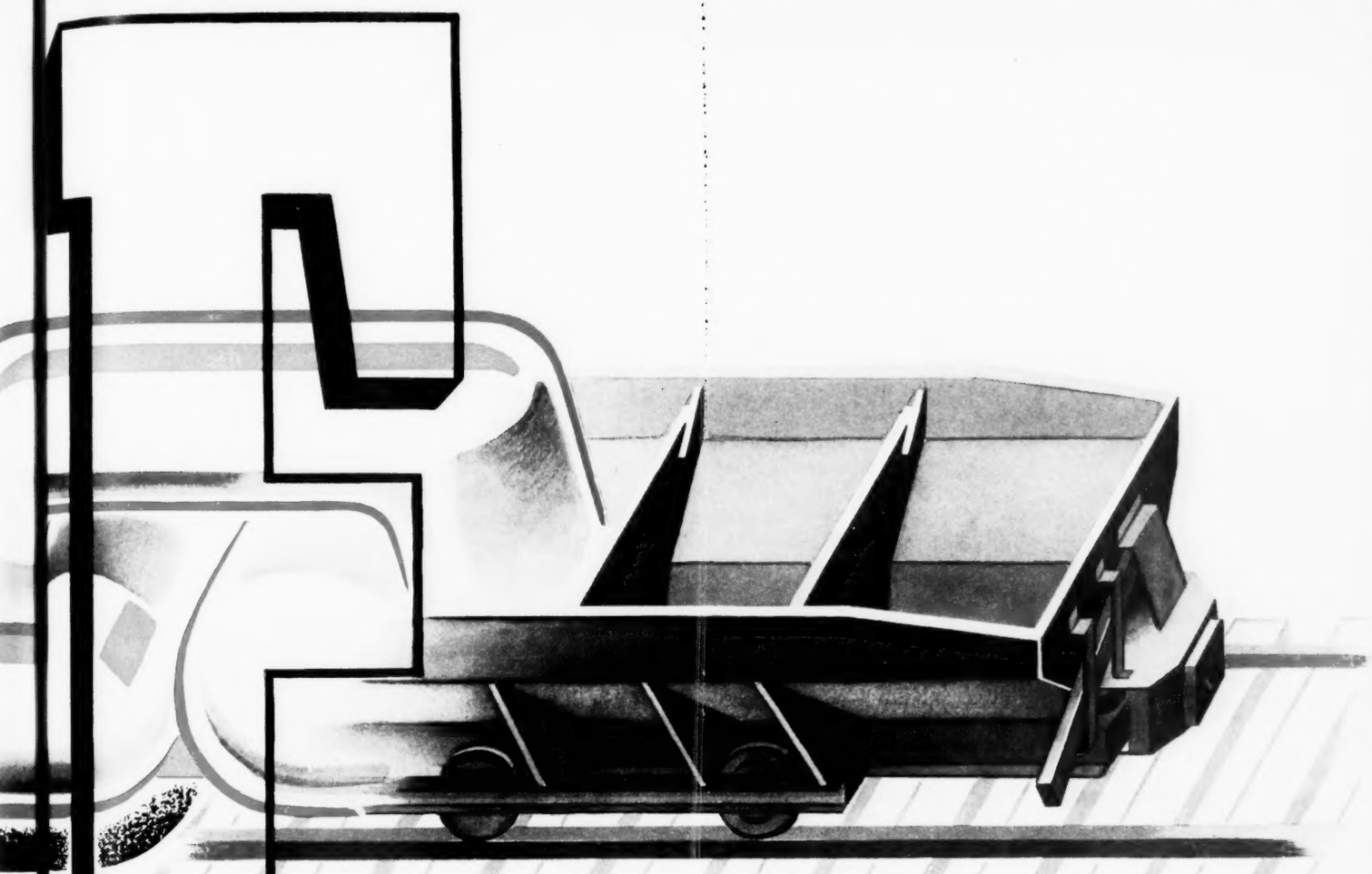
For maximum performance; for low power costs, minimum maintenance costs; for safety and constant service, you need the "Automat"! Write for complete information. Myers-Whaley Co., 1102 Proctor Addn., Knoxville, Tenn.

MYERS-WHALEY

"Mechanical Loaders Exclusively For Over 35 Years"




FOR VICTORY
BUY
UNITED
STATES
DEFENSE
BONDS
STAMPS



First link

in the chain of Victory!

By the thousands, and by the tens of thousands, the mine cars of America shuttle up their precious loads of coal and ore—*power-in-the-making . . . power to compel victory!* Great is the burden upon all mine cars today—and it will grow even greater through the months to come.

If new cars will be needed, place your order now, for materials are hard to get. If you need car parts, wheels, complete trucks, or any equipment we can supply, you can be sure we'll serve you most satisfactorily.

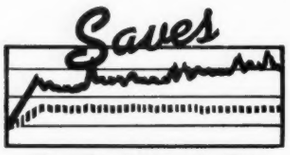
Whether your need is for new mine cars, or parts for keeping your old cars in service longer, now more than ever before it is most important to get the best possible equipment—and to look to A.C.F. to supply it.

A.C.F. Chilled Tread Mine Car Wheels, as manufactured under our heat-treating process, are made from a special mixture of metals — better for mine car wheels than steel or iron, alone.

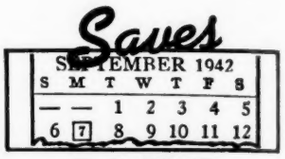
a.C.f.

AMERICAN CAR AND FOUNDRY COMPANY

SPACE



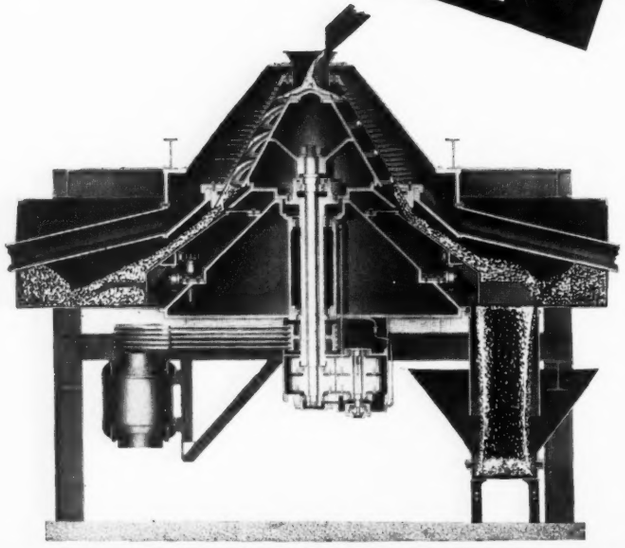
POWER



TIME

GET THOSE FINER COAL SIZES DEWATERED AND DRIED *in Quickest* TIME . . .

"C-M-I" *Continuous Centrifugal* DRYER



★ Carload after carload of the finer coal sizes are shipped quickly when the "C-M-I" Continuous Centrifugal Dryer is used.

And besides the three savings you secure lowest first cost and lowest operating cost.

Eliminating the freezing of coal in transit or storage and the clogging of cars, spouts and bins.

An important aid, particularly for these times.

CENTRIFUGAL AND MECHANICAL INDUSTRIES, INC.

SECOND AND PRESIDENT STREETS ST. LOUIS, MO.

DON'T SABOTAGE YOUR OWN MINE EQUIPMENT

And that's exactly what you do if you neglect it or fail to properly maintain its electrical cables. Use every precaution for the protection and longevity of cables and portable cords used to furnish energy for the operation of mining equipment.

Hazacord Electric Shovel Cables, for instance, defy abrasion from sharp rocks, cinders and like substances. Their mold-cured sheaths are built to take punishment. They can lie in the sunshine and weather for months without serious injury, but they will last longer with proper care. Hazacord Electric Shovel Cables are made in several designs:

TYPE W has no shielding or ground wires. It is made in a variety of sizes, strands and diameters. This type is suitable for 2500-volts or less.

TYPE G is the same as type W, except that it has stranded ground wires in the interstices. It is suitable for from 2500 to 5000-volts. The ground wires are equivalent in carrying capacity to one of the insulated conductors. They should be well grounded at both ends of the cable.

TYPE SH, Shielded, is made in several styles and are all suitable for voltages from 5,000 to 7,000:

SH-A—with shielding braid over each conductor to prevent formation of corona and its attendant ozone which quickly attacks rubber. The shield also drains static charges to ground and prevents shock when handling "hot" cable.

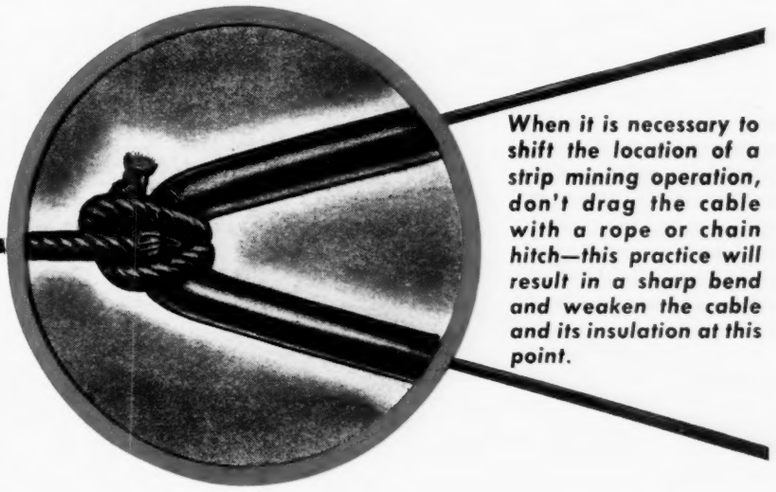
SH-B—with shielding braid over cable assembly instead of each conductor. Protects workmen handling cable.

SH-C—same as SH-B but, in addition, has ground wires laid in the interstices of the cable in contact with the shield.

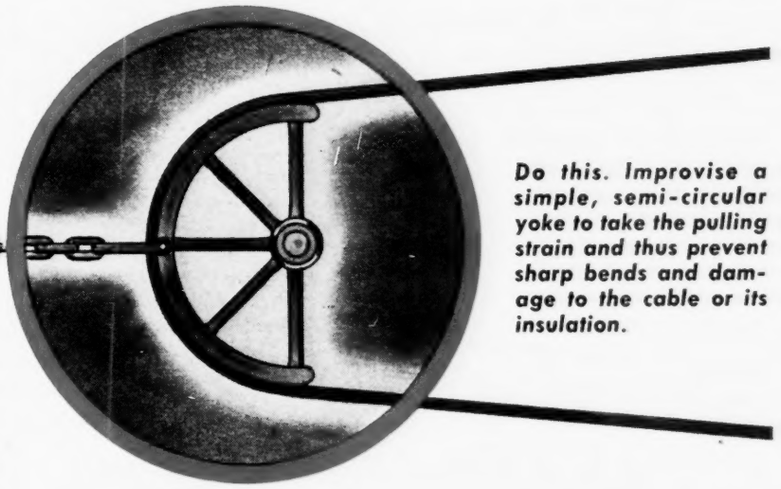
SH-D—With shielding braid over each conductor and ground wires in interstices of cable.

Special cables, with tough protecting jackets, can be made to any desired specifications.

Our engineers can provide you with all the do's and don'ts to prolong the life of Hazacord mining cords and cables. Our Research Department is developing new ideas daily. Before placing an order for new cable, consult our representative as to your needs. Perhaps one of our new developments which eliminates the use of vital war materials may be just the solution to a problem you have. We are making every effort to supply insulated wire and cable for the war effort and other vital needs within the limitations imposed upon us.

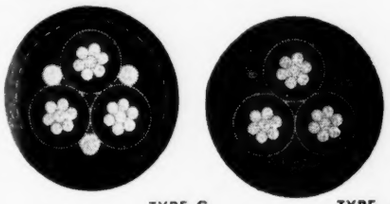


When it is necessary to shift the location of a strip mining operation, don't drag the cable with a rope or chain hitch—this practice will result in a sharp bend and weaken the cable and its insulation at this point.



Do this. Improvise a simple, semi-circular yoke to take the pulling strain and thus prevent sharp bends and damage to the cable or its insulation.

HAZARD INSULATED WIRE WORKS
DIVISION OF THE OKONITE COMPANY
Works: Wilkes-Barre, Pennsylvania
Offices in Principal Cities



TYPE G TYPE W

HAZARD
Insulated Wires & Cables

"BUY U. S. WAR BONDS... Every Payday All Hazard Employees BUY U. S. WAR BONDS"

PRACTICAL METHODS OF LUBRICATING YOUR WIRE ROPE

. . . to help you get longer service . . . to help you conserve steel

The benefit derived from systematic lubrication of wire rope is one of those apparently intangible things that are difficult for the average user to find among his many operating problems. However, laboratory and scientifically controlled field tests have proved that wire rope, like any machine part, lasts longer if it is kept well lubricated.

What are some simple ways to lubricate wire rope on your job?

Preparation

It is very desirable that the rope be clean and dry. A jet of air, steam, or wire brushing, followed by a period in which the rope is allowed to dry, are some of the methods used preparatory to applying the lubricant.

First, you can brush the lubricant on to the rope

FIG. 1

Illustrated, in Figure 1, is one easy and effective method of applying lubrication. Dip the brush into the lubricant and apply. In some cases a rag or piece of sheepskin is dipped in the lubricant and used to swab the lubricant on to the rope.

Applying by hand with leather gloves

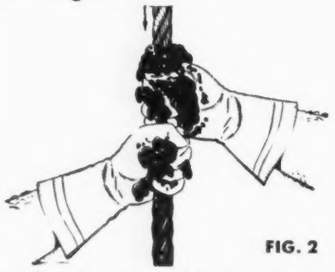


FIG. 2

Another simple method is shown in Figure 2. Leather is preferred to canvas, because of its greater protection and less penetration of the grease.

This method is especially good where a heavy, non-flowing lubricant is applied. It is often desirable to heat lubricant slightly to get a smoother, better application.

You can make a simple lubricating device

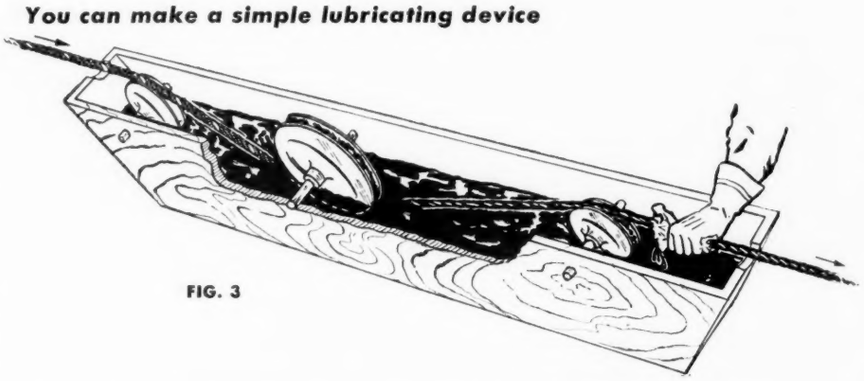


FIG. 3

A wooden trough with a sheave mounted on a shaft does a good job.

Such a trough, or slush box, is illustrated in Figure 3. The rope is run over the end of the trough, under the sheave, and out the other end so that the rope runs through the lubricant. A rag or swab held in place at the outgoing end wipes off excess lubricant. A slush box for vertical ropes is shown in figure 4.

Proper lubrication helps to seal in the Macwhyte internal lubrication that covers each wire during the manufacture of the rope. It helps to keep out water and dirt, and guards against corrosion.

Regular inspection of the rope with frequent applications of lubricant produces better results than heavy coatings less frequently applied.

The methods illustrated are those in most common use and cover most wire rope applications. Various methods used in service often depend upon the particular type of lubricant and whether it is applied hot or cold.

The use of wire rope varies so greatly that it is not possible to set forth here any particular types of lubricant to use. Macwhyte engineers are always glad to give you the benefit of their experience in special cases.

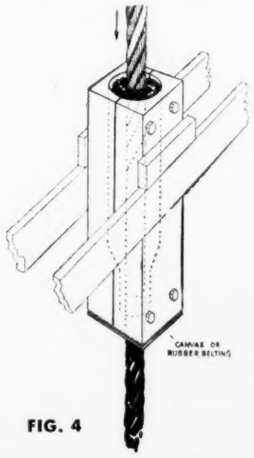


FIG. 4

This is number 12 in a series of informative articles prepared by the Macwhyte Wire Rope Company. All articles in this series are available on request.

MACWHYTE COMPANY
2940 Fourteenth Avenue • Kenosha, Wisconsin
Mill Depots:
New York • Pittsburgh • Chicago
Ft. Worth • Portland • Seattle • San Francisco
Distributors throughout the U. S. A.

Macwhyte Company Manufactures:
MACWHYTE PREformed and Internally Lubricated Wire Rope
MONARCH WHYTE STRAND Wire Rope
MACWHYTE Special Traction Elevator Cable
MACWHYTE Braided Wire Rope Slings
MACWHYTE Aircraft Cables and Tie Rods

NO. 641
MONARCH
Whyte Strand
PRE-FORMED
WIRE ROPE
Macwhyte's premier wire rope, famous for its strength, toughness, and internal lubrication.

WESTINGHOUSE *Hydraulic* BRAKES

Reduce LOCOMOTIVE Maintenance

Typical Results . . .
Reported by One User are:

Brake Shoe Life Increased from One Week to Three Months

★

Wheel Turning Decreased 50 per cent

★

Motor Bucking to Check Speed, or Stop, Entirely Eliminated

★

Shocks to Mechanical and Electrical Apparatus Greatly Reduced

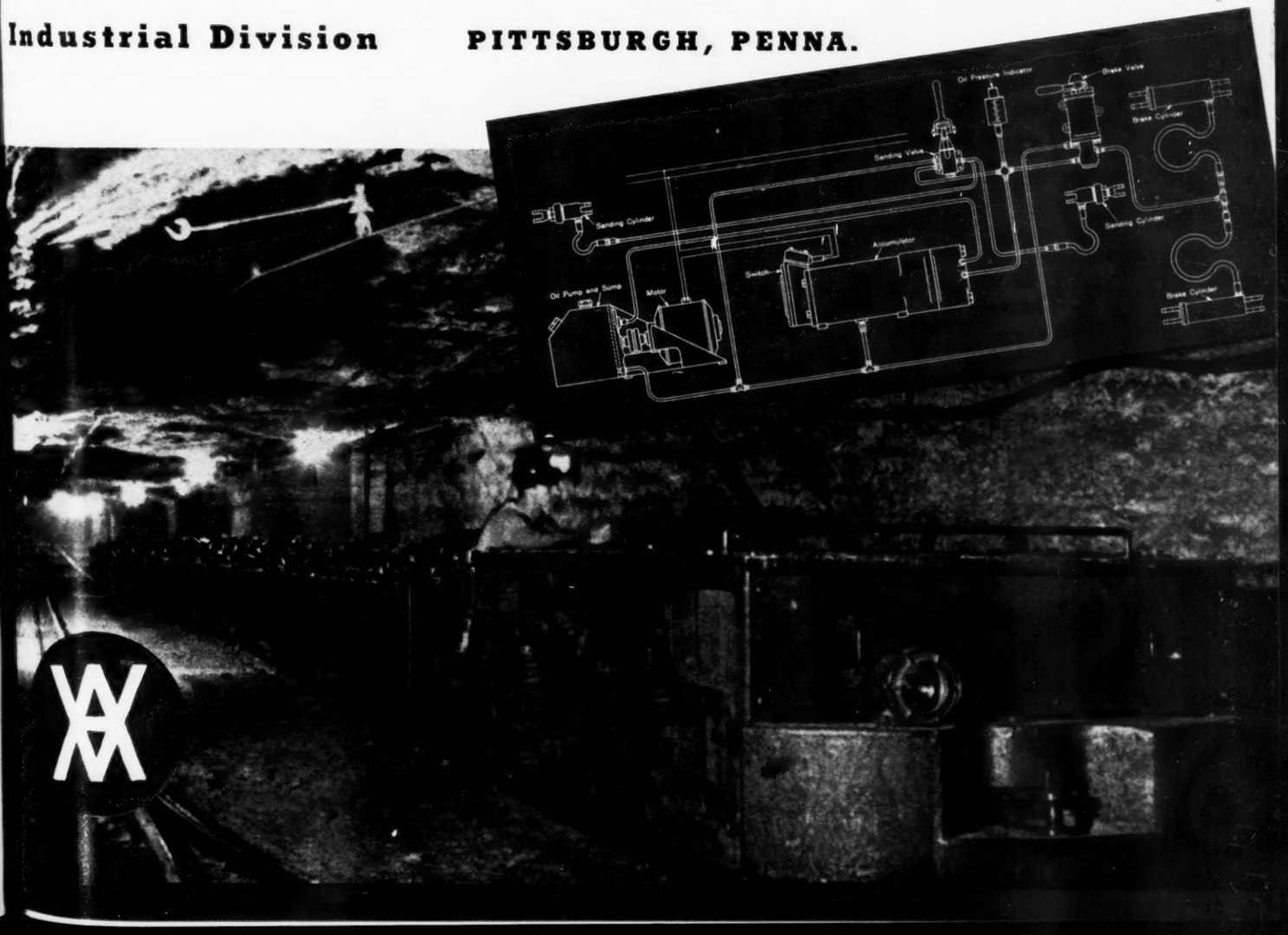
★

Less Sanding Required—Better Rail Contact Cuts Power Loss and Overheating

This mining company now has six locomotives equipped with the Westinghouse Hydraulic Brake. Conversion of the entire fleet is on their betterment program ★ The Brake responds instantly, is easy to manipulate. Any required braking intensity can be quickly attained, and precisely adjusted ★ In addition to reduced maintenance and greater availability, the operating efficiency is increased. Faster loading, more cars kept rolling, more trips made, uniform time-saving speeds down varying grades, in safety ★ This hydraulic system is simple and compact, easily installed on any small locomotive, new or old. The few hours out of service *once* for installation, will prevent several days out *many times* for maintenance. Investment is soon absorbed by savings — returns in greater productiveness continue ★ It will pay YOU to consider the advantages of Westinghouse Hydraulic Brakes NOW.

WESTINGHOUSE AIR BRAKE CO.

Industrial Division **PITTSBURGH, PENNA.**



Grip a Bending V-Belt

You'll See *How* the CONCAVE SIDE

Saves Belts-Saves Rubber-Saves Power!

Bend *any* V-belt and you can feel it change shape! The top is under tension and grows narrower. The bottom is under pressure—therefore it widens. These two conflicting stresses force a straight-sided V-belt to *bulge* in the sheave groove. (See figure 1 on the right.) This bulging causes uneven wear on the sides of the belt—*shorter life!*

Now look at figure 2. There you see what happens if the V-belt is built with the patented Concave side. The stresses of bending merely straighten the Concave side—making it exactly fit the sheave groove. This means uniform wear and, therefore, *longer life*—a saving in belts, a saving in the Nation's rubber supply. Again, the full side of the belt *uniformly* grips the pulley—carries heavier loads without slipping—another saving of belts and a saving in power too!

Only belts built by Gates are built with the Concave side, a Gates patent.

What Happens When a V-Belt Bends

FIG. 1

FIG. 2

THE GATES RUBBER COMPANY

Engineering Offices and Stocks in All Large Industrial Centers

GATES VULCO ROPE DRIVES

Chicago, Ill. 549 West Washington
New York City 215-219 Fourth Avenue
Atlanta, Georgia 738 C. & S. Natl. Bk. Bldg.
Los Angeles, Cal. 2240 East Washington Blvd
Denver, Colo. 999 South Broadway
Dallas, Tex. 2213 Griffin Street
Portland, Ore. 333 N. W. 5th Avenue
San Francisco, Cal. 2700 16th Street

SCHWAGER COAL CO.
MACON COUNTY COAL CO.
MALLORY COAL CO.
UNION COLLIERIES COMPANY
HAZEL BROOK COAL CO.
UNITED STATES COAL & COKE CO.
OUTH UNION COAL COMPANY
Y COAL & COKE COMPANY
ORGES CREEK COAL COMPA
N ALDEN COAL COMPANY
GORA COAL CO., INC.
T GAGE COAL COMPANY
N COAL & COKE COMPANY
HANNA COMPANY, AGENTS
SON COAL COMPANY
TEEL COMPANY
COAL & COKE C MPANY
DAL COMPAN
EK COAL C
CAHONTA
Y COAL C
COAL COM
AUNTON COAL C
COMPANY
ORP., INC.
ERN RAILWAY CO.
MPANY
MINING CO.
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RPORATION
& R. R. CO.
NG COMPANY
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EMERALD COAL & COKE CO.
PAGE POCAHONTAS COAL CO.
JEDDO-HIGHLAND COAL CO.
BICKNELL COAL COMPANY
BERWIND WHITE COAL MINING CO.
CHRISTOPHER MINING COMPANY
COAL RUN COAL COMPANY
COAL CO NY
CREEK CO
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PANY, LTD.
FORD COLLIERIES COMPANY
EAST BEAR RIDGE COLLIERY CO.
ENSBURG COAL COMPANY
LIN COUNTY COAL CORP.
& COKE COMPANY
COMPANY
NY
IY
OMPANY
INLA
JAMISON
KOPPERS COA
KELLEYS CREEK COAL
KINGSTON-POCAHONTAS COAL CO.
LEHIGH VA
LOW VOLA
MT. OLIVE &
THE NEW RIV
NORTON COA
NORFOLK & W
PEABODY COAL
PROVIDENCE COA
THE REX COAL C
RED JACKET COAL
TENNESSEE COAL, I
TURNER ELKHORN M
UNITED STATES GYPS
VOLPE COAL COMPAN
WINDING GULF COLLIE
WESTMORELAND COAL COMPANY
WHEELING VALLEY COAL CORP.
WEST KENTUCKY COAL COMPANY
WASSON COAL COMPANY
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HOWARD
LINTON-SU
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PRINCETON
STEVENS COA
UTILITIES ELKH
WHEELING TO
MACON COUNT
MALLORY COAL
NION COLLIERIE
AZEL BROOK CO
TED STATES CO
OUTH UNION COA
POWHATAN MINING
RA COAL CO
STEEL CORP.
OAL & COKE
Y, LESSEE
Y CO.
COLLIERY, IN
CO.
ERIES CO.
ERIES
COAL CO., IN
L CO.
CO.
OAL CO.
COAL CO.
PENNSYLVANIA COAL COMPANY
PHILADELPHIA & READING COAL &
NEW RIVER & POCAHONTAS CONS.
CHICAGO, WILMINGTON & FRANKLIN
THE YOUGHIOGHENY & OHIO COAL C

NOLAN

Our Engineers will gladly help you get the utmost use of your NOLAN Equipment. Feel free to call on them for an inspection.

Nolan Rotary Dumpers and Car Control Devices are giving dependable service in coal mines all over the country. This equipment is built to stand the shock of heavy service. But, like any mechanized device, it requires a reasonable amount of attention. Keep it well lubricated, inspect it at regular intervals, anticipate wear or trouble, and you will get the long, satisfactory service the name NOLAN typefies.

Proper care of mining equipment is *always* advisable. But in times such as these, it is *vital.*

Parts for your Nolan equipment can be shipped promptly upon receipt of your request.

THE MINING SAFETY DEVICE CO.,

BOWERSTON, OHIO

. . . and a Cities Service lubrication engineer to help you step-up production efficiently and economically!

Every mining operator today faces tougher problems than he ever has faced before. For Uncle Sam demands more and more coal — the power *behind* industrial power for total production!

You can achieve this only with continuous, efficient operation minus costly delays caused by mechanical troubles.

Why not start out right by having the lubrication phase of your problem studied for you by a Cities Service lubrication engineer? He will recommend a plan designed especially for your job—a plan for full capacity operation that will mean dollar and cents economy for you.

Just drop a line on your letter-head requesting that a lubrication engineer call. There is no obligation, of course.

OIL IS AMMUNITION — USE IT WISELY!

CITIES SERVICE OILS
ONCE-ALWAYS

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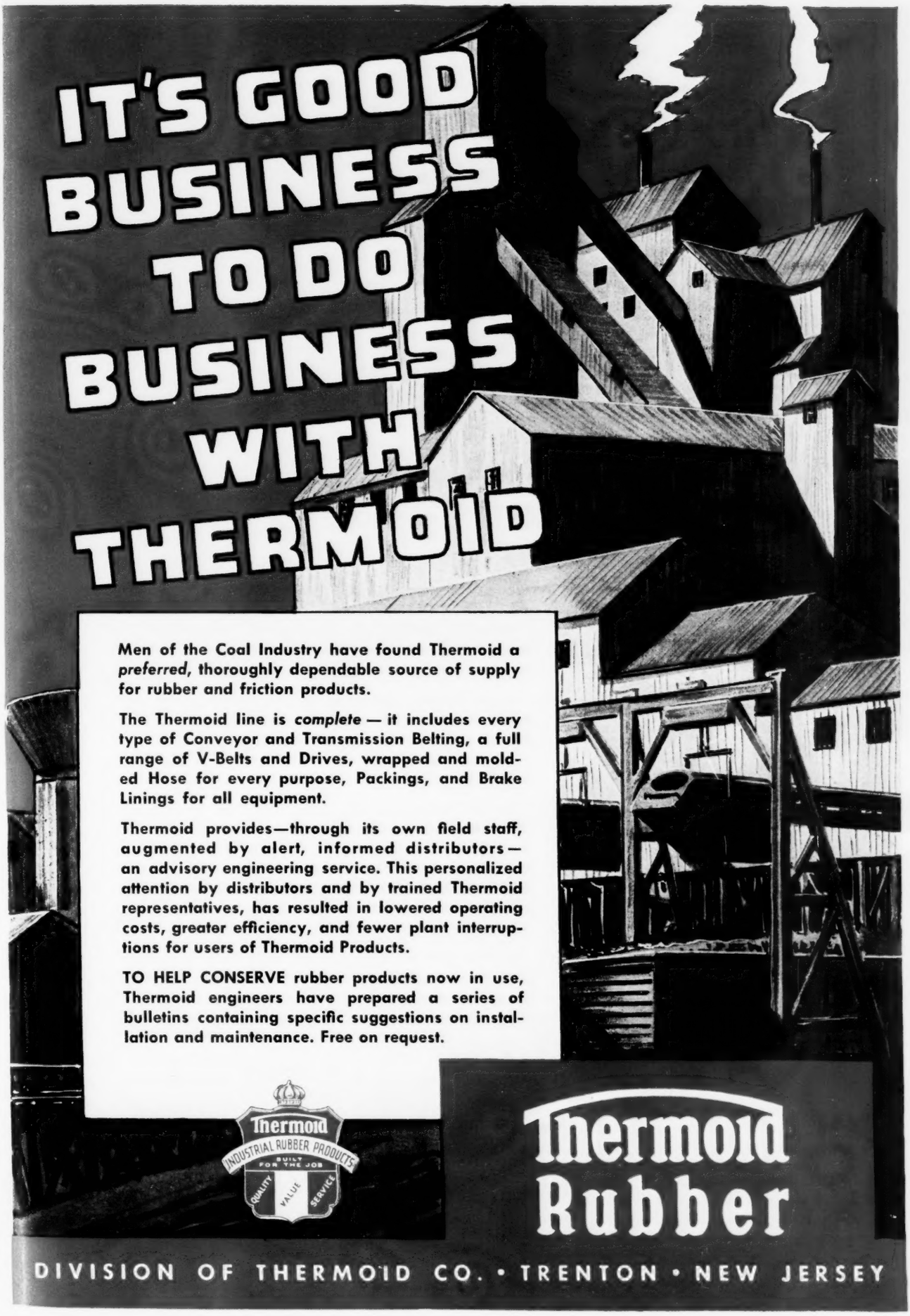

Men of the Coal Industry have found Thermoid a *preferred*, thoroughly dependable source of supply for rubber and friction products.

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BUILT FOR THE JOB
QUALITY VALUE SERVICE

Thermoid Rubber

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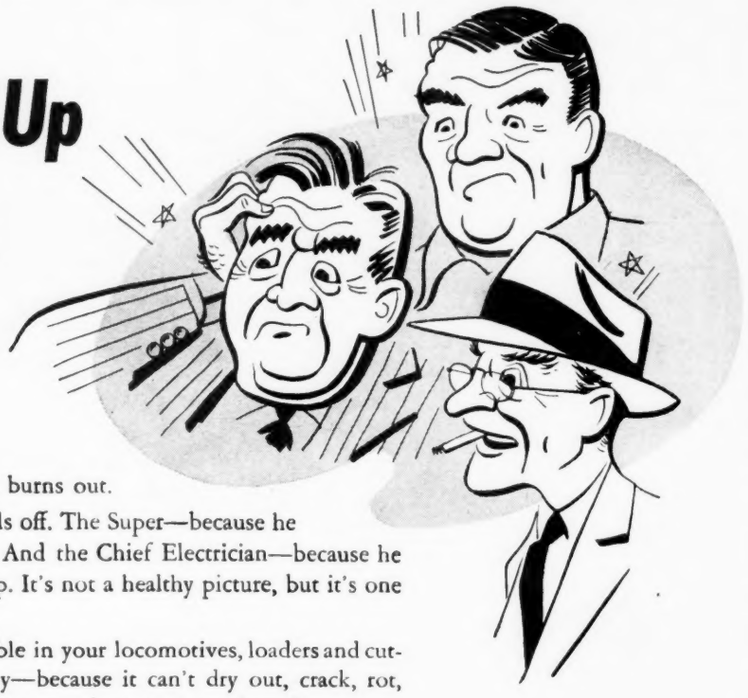
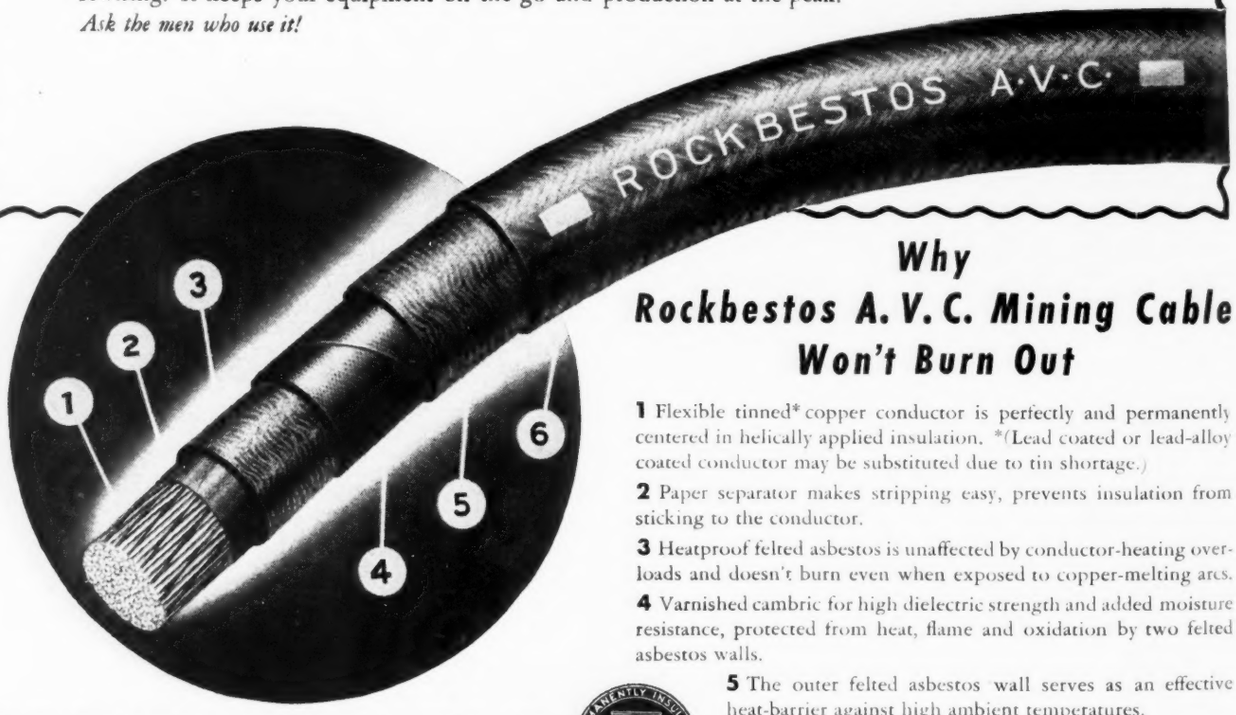
Who Burns Up when cable burns out?



They all burn up when equipment burns out.

The Operator—because tonnage falls off. The Super—because he has dead equipment on his hands. And the Chief Electrician—because he has another rewiring job in his shop. It's not a healthy picture, but it's one that is easily corrected.

Use Rockbestos A.V.C. Mining Cable in your locomotives, loaders and cutters, and you'll keep everyone happy—because it can't dry out, crack, rot, bloom or burn. It has insulation that *stands up permanently* under copper-heating overloads, oil and grease. It practically eliminates failures, fires and rewiring. It keeps your equipment on the go and production at the peak. *Ask the men who use it!*



Why Rockbestos A. V. C. Mining Cable Won't Burn Out

1 Flexible tinned* copper conductor is perfectly and permanently centered in helically applied insulation. *(Lead coated or lead-alloy coated conductor may be substituted due to tin shortage.)

2 Paper separator makes stripping easy, prevents insulation from sticking to the conductor.

3 Heatproof felted asbestos is unaffected by conductor-heating overloads and doesn't burn even when exposed to copper-melting arcs.

4 Varnished cambric for high dielectric strength and added moisture resistance, protected from heat, flame and oxidation by two felted asbestos walls.

5 The outer felted asbestos wall serves as an effective heat-barrier against high ambient temperatures.

6 Heatproof, fireproof asbestos braid, resistant to moisture, oil, grease and alkalies, is diametered to properly fit bushings.

Order from the jobbers listed below. For sizes and diameters refer to McGraw-Hill Coal Mining Catalogs or write Rockbestos Products Corporation, P. O. Box 1102, New Haven, Connecticut.

ROCKBESTOS A.V.C.

PERMANENTLY INSULATED WIRES AND CABLES — ROCKBESTOS

The Cable with Permanent Insulation

ORDER FROM THESE JOBBERS — SPECIFY "ROCKBESTOS A. V. C."

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BIRMINGHAM, ALA.: Moore-Handley Hdwe. Co.
BLUEFIELD, W. VA.: Superior-Sterling Co.
CLEVELAND, OHIO: Upson-Walton Co.
EVANSVILLE, IND.: Evansville Elec. & Mfg. Co.
FAIRMONT, W. VA.: Fairmont Supply Co.
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Westinghouse Elec. Supply Co.
SCRANTON, PA.: Penn. Elec. Engineering Co.
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GET THESE FEATURES

when you buy mine motors

ANTIFRICTION BEARINGS

Smooth-running ball or roller bearings withstand end thrust from either direction, stay smooth. Grease is sealed in, dirt is sealed out. SK Motors are also available with the famous Sealed-Sleeve Bearings.

RIGID, ROLLED STEEL FRAME

Rigid, one-piece frame provides a uniform magnetic path, and vastly improves commutation. Forged steel feet welded to the frame anchor the motor securely in place and prevent twisting or weaving.

FORM-WOUND, MICA-INSULATED COILS

Armature coils are individually form-wound and insulated before assembly. Selected mica over the slot portions, and repeated dipping and baking in insulating varnish effectively prevent electrical breakdowns.

EASILY ADJUSTED BRUSH HOLDERS

All brush holders are readily accessible. Any one of them may be adjusted or removed with an ordinary screw driver or wrench without disturbing the others. Rotating end bracket adjusts position of brushes.

DEEP COMMUTATOR BARS

Extra deep segments of hardened copper insure long life. Wedge design tightly locks commutator assembly, prevents high bars. As a result, commutation is practically sparkless, even under severe overloads.

COMPLETE SELECTION

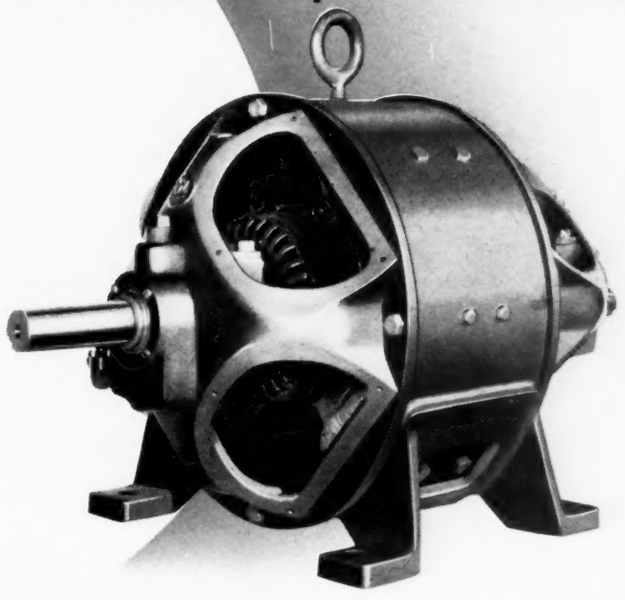
SK Motors are available from 1 to 200 hp with the proper torques and performance characteristics, ratings and enclosures to meet every mining requirement, and to do every mining job.

PLUS

INTERCHANGEABLE PARTS to cut costs . . . speed maintenance

Wearing parts on SK Motors have been held to the same dimensions for 29 years. Parts for today's motors will fit the oldest SK Motor in your mine. By standardizing on SK Mine Motors you simplify and reduce your replacement parts supply problems. Maintenance is speeded up, parts can be replaced quickly, motors returned to service sooner.

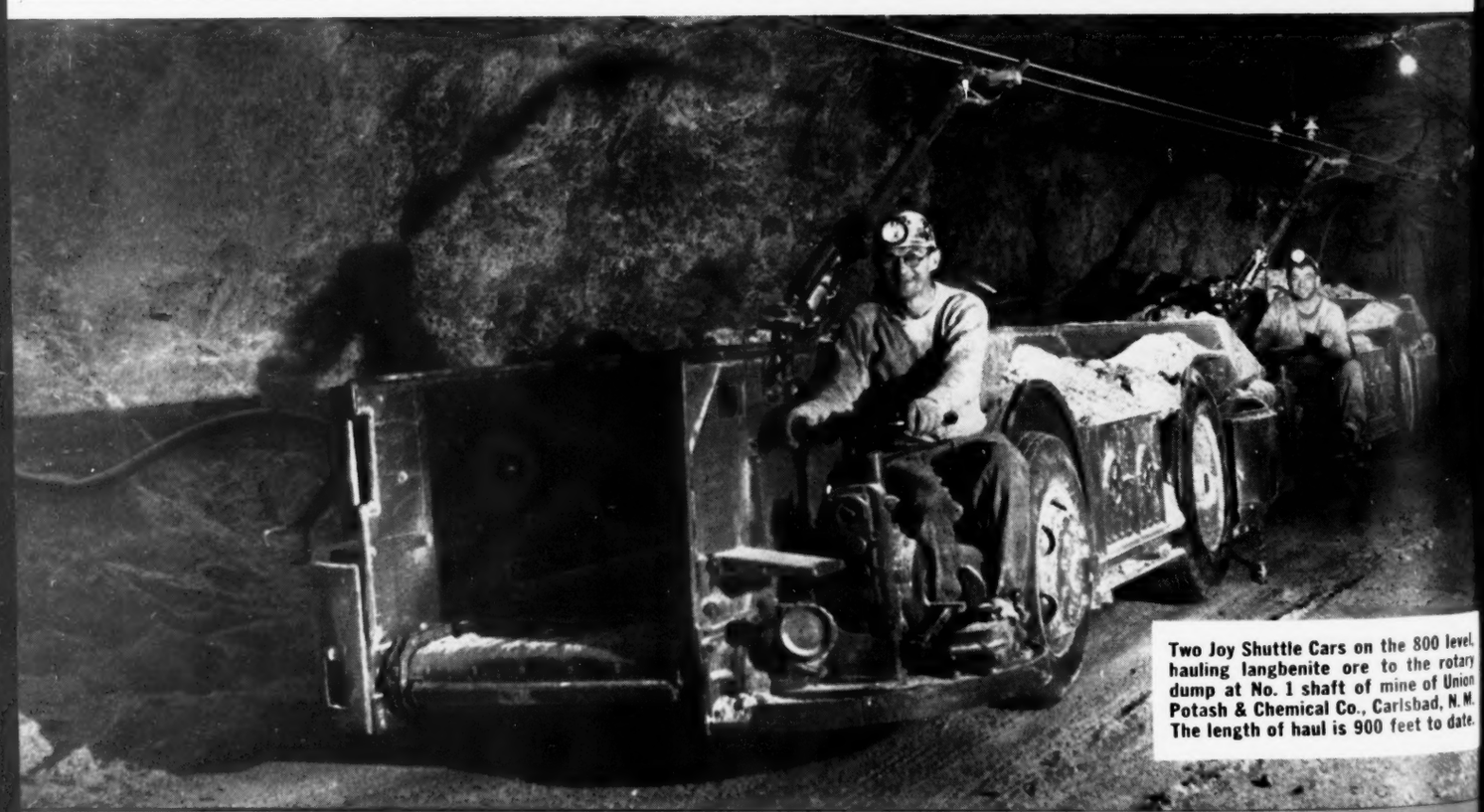
SK Mine Motors have been standard for underground service since 1911. Today, more Westinghouse Motors of this type are in use than any other make. It will pay you to standardize on them in your mine. Call your nearest Westinghouse representative for complete information. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., Dept. 7-N. J-21211



Westinghouse **SK Mining Motors**

Mechanize with J

Big lumps or little lumps, the Joy Loader handles them all—fast, easily.



Two Joy Shuttle Cars on the 800 level, hauling langbenite ore to the rotary dump at No. 1 shaft of mine of Union Potash & Chemical Co., Carlsbad, N. M. The length of haul is 900 feet to date.

MORE TONNAGE AT LES

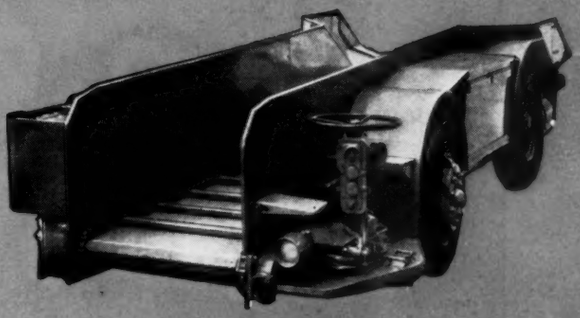
JOY EQUIPMENT

The Human Element is Vital...Even to Rugged Mechanized Equipment

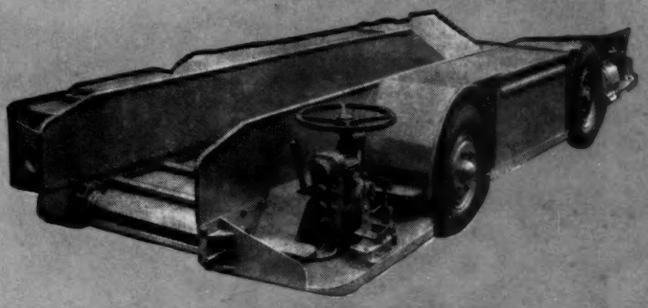
THE maintenance of Joy equipment has been simplified and expedited by skillful designing and "built-to-take-it" fabrication.

Properly trained and educated men are, however, a prime essential to low up-keep and continuous operation—and the rapid mechanization of America's mines makes this a more vital need today than ever before.

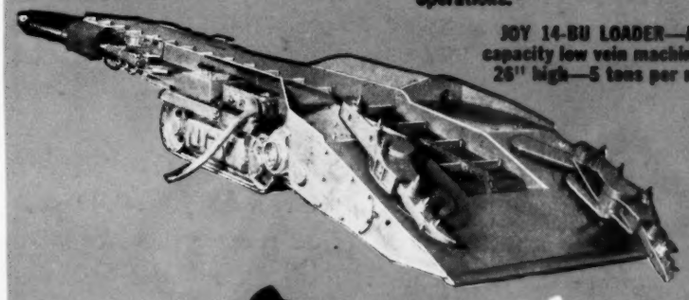
We urgently suggest that genuine Joy parts should always be used to get maximum, efficient machine performance.



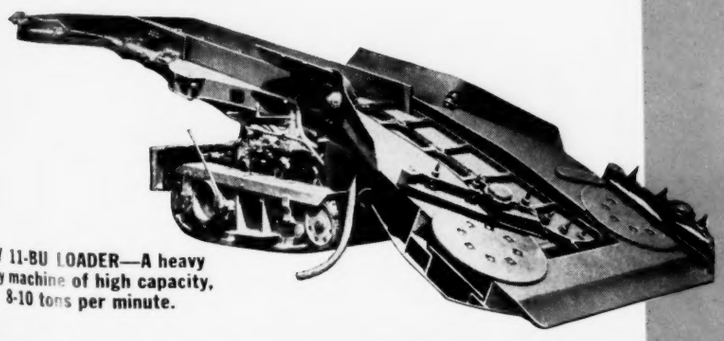
JOY 42" SHUTTLE CAR
6 tons capacity for high seams.



JOY 32" SHUTTLE CAR
3½ ton capacity for low seam operations.



JOY 14-BU LOADER—A high capacity low vein machine—only 26" high—5 tons per minute.



JOY 11-BU LOADER—A heavy duty machine of high capacity, 8-10 tons per minute.

Consult a Joy Engineer

JOY
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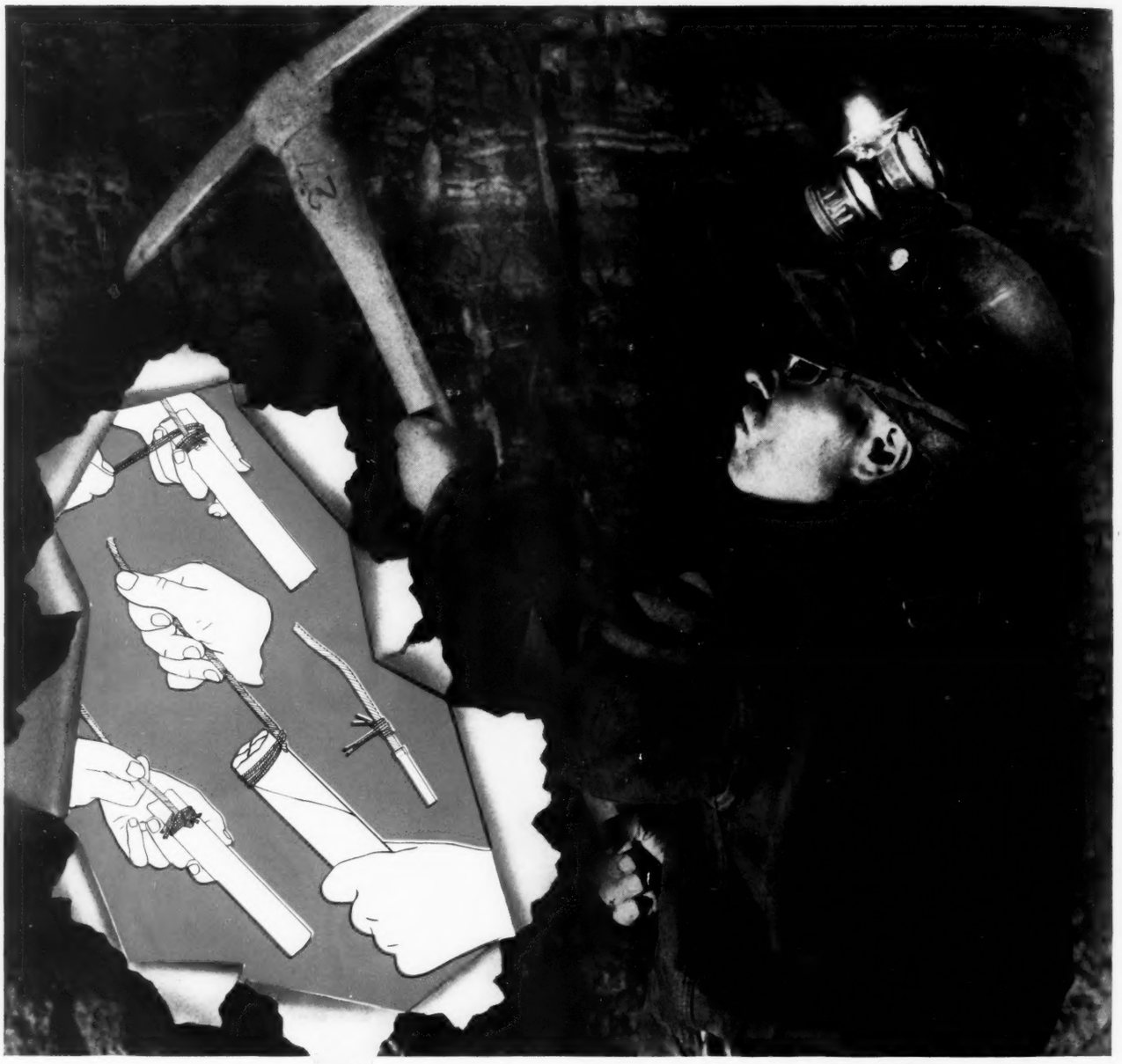
COST . . . WITH JOY



Photograph taken in an iron mine

Tied--on the Side of Safety

When you use the side punch, be sure to tie the fuse securely against the cartridge, as illustrated. Tarred twine is best for this job. Held taut at the side of the cartridge, the fuse is out of the way of the tamping stick. Avoid kinks and sharp bends that might crack the waterproof coating. Tie the fuse tight—at the side—and be on the side of safety!

Use Ensign-Bickford Safety Fuse for better blasting results. There's a brand designed to meet the conditions in your mine.

THE ENSIGN-BICKFORD COMPANY • SIMSBURY, CONN.

Manufacturers of Safety Fuse since 1836—also Primacord-Bickford Detonating Fuse

SF-129

ENSIGN-BICKFORD SAFETY FUSE

The Chemical Engineer cuts years to months...

Born in the turmoil of the last war, he is shaping a new world with mighty swords and magic plowshares

GERMAN CONSUL-GENERAL HOSSENFELDER, writing from New York on March 3rd, 1916, to von Bethmann-Hollweg, chancellor of the Imperial German Government, confidently predicted defeat for the United States because we were totally dependent upon the great chemical industry of Germany. "Americans," he wrote, "can never establish such an industry. They have the resources but they lack the necessary science and technology. And, besides, the conflicting selfishness of American business renders it impossible."

Even before the ink was dry on Hossenfelder's letter a new figure appeared on the industrial scene—the American chemical engineer. With the help of patient, but progressive and venturesome capital, he laid the foundations for the largest and most resourceful chemical industry in the world.

Today he is an all-important figure. For we are fighting a chemical war, even though the emphasis that is placed on planes, tanks, ships, guns and other armament tends to obscure that fact. And this chemical engineer is waging war for us on a prodigious scale. Bombers carry more tons of more deadly explosives because he has developed stronger and lighter alloys and more efficient fuels. Tanks are better armored and wield heavier blows because of products and processes born in chemical laboratories. Ships are welded together by new metallurgical techniques that save precious months over older processes. Gun barrels that are made in minutes instead of hours shoot farther and faster because of better ammunition.

And quantity keeps pace with quality. By mid-year of 1942, explosives were being produced in newly constructed plants twelve times faster than a year ago. Smokeless powder output has been doubled since December. Five times as much TNT was being made in July as in the months preceding Pearl Harbor. One single new plant produces more of this high explosive than did the entire pre-war industry—and several of these plants already are in production.

By what Major General William N. Porter, Chief of the Chemical Warfare Service, calls a "miracle of production," the sort of incendiary bombs that General Doolittle's lads showered on Tokyo were rolling out of our plants within a few weeks after we got into the war. As General Porter puts it, "they were rolling not by hundreds or even thousands, but by the millions." That record he has cited as a tribute to the "ingenuity, industriousness and patriotism" of the American chemical industries.

Yet the General agrees that we have only started to produce in the tremendous volumes that will shortly make Germany, Italy and Japan "revolve on their boasted Axis." Our newest plants are just coming into production. They face no limiting shortages of materials for, in the main, our chemical industry draws its strength from coal, salt, sulphur, limestone, oil, natural gas, coal-tar, air and water—all available in abundance.

We have heard little about the use of poison gas by our enemies. It may be that good reasons for this are stored away in our well-stocked chemical arsenals. American chemical manufacturers have worked hard and long with our armed forces so that if the time ever comes to make good on the President's warning of retaliation, America will be more than ready.

And defense against gas has not been overlooked. Every soldier is equipped with a most efficient type of gas mask, developed through twenty-five years of intensive research. The Chemical Warfare Service already is manufacturing millions of masks for distribution to civilians. Let us hope we may never have to use them. But if we must, we need have little fear of any gas or secret chemical.

This gas mask program has been made possible by a literal metamorphosis of production facilities, as peacetime industries have been converted to war purposes. A lumber company, for example, is making activated carbon from sawdust. Novelty manufacturers of rubber goods are turning out valves and assembling other parts. Former manufacturers of shirts, swim-suits, shoes and beds have converted their facilities and are contributing their share. More than eleven hundred contractors and two hundred and fifty sub-contractors are supplying their full quotas of chemical warfare materials. And production is right up to schedule.

But the bulk of the war job of our chemical industries has to do with items other than weapons and

ammunition. The German Consul-General, in that 1916 report to Berlin, said that many American industries were in a critical condition because of the scarcity of German chemicals. He related in particular that "the cries for help from the world of physicians are becoming louder and louder and more and more insistent." Thanks to our chemical industries this cry no longer is heard. Even though we are again cut off from quinine, camphor and some other strategic medicinals, our homes and hospitals are adequately supplied with synthetic products. Most of these are better and cheaper than the natural materials. The same sulfa drugs that have saved so many civilian lives in recent years have gone to war, with the result that deaths from infection at Pearl Harbor and Bataan are reported as surprisingly low. In this war we suffer no shortages of iodine and potash. Pioneering research in the field of vitamins has led to new industries that are contributing to health and better nutrition.

Those new uniforms the soldiers are wearing are of better quality and will last longer than the shoddy, ill-fitting outfits of 1918—thanks to sunfast dyes and new man-made products. And in the field of fabrics, nylon and the new rayons have gone to war in parachutes and super-strong cords for tank treads and tires.

* * * * *

And that brings up the question that 30,000,000 American motorists are asking with ever increasing concern. "When, Mr. Chemical Engineer, are you going to give us a set of new tires for the old family bus?"

That, I am told, is just what the chemical engineers have set about to do on a scale that is difficult to comprehend. In the words of Raymond Clapper, the columnist, "the synthetic rubber program for this year and the next is the biggest job of chemical engineering ever undertaken in the world." A billion dollar industry is being built at record speed to make almost a million tons a year of chemical rubber to serve our war needs and those of our allies. This cannot be accomplished overnight. Many months are required to design and fabricate complex equipment, much of which must be made from corrosion-resisting metals and alloys. We shall be lucky if a tenth of the desired capacity is in continuous production this year and even more lucky if, by the end of next year, the new industry should be turning out synthetic rubber at a rate of 875,000 tons—using both petroleum and grain as raw materials.

All this, of course, must go for essential military uses but there is reason to believe that in the laboratory and pilot-plant stages we have some promising substitutes and stop-gap materials that may tide us over until the big program starts rolling.

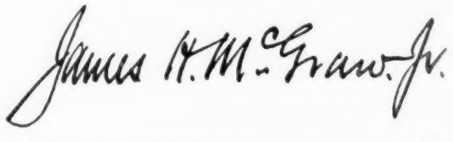
The present prospect of real success is possible only because of the cooperation of the chemical, rubber and petroleum industries. Individual firms and entire industries have set aside their normal desires and selfish interests to pool their patents, share their research and engineering developments for the common good. Synthetic rubber is here to stay as the basis for a great post-war industry: no doubt as to that lingers in the minds of the men who have seen many other natural products—indigo, alizarine, camphor, vanillin—all eventually fall before the ingenuity of the chemical industry.

* * * * *

In the coming peace to which we look forward hopefully, we shall find a new world full of new materials, new conveniences, new jobs, new opportunities, all stemming out of the present-day work of the chemical engineer. The same tough, transparent plastics that now make noses for bombers will give us new frameless windows for our homes and automobiles. With capacity to produce at least 2½ billion pounds of aluminum, which is five or six times pre-war production, and a magnesium capacity 50 or 60 times the pre-war figure, many new uses will develop for these structural materials of great strength and amazing lightness. Almost anything that flies, runs, moves, or otherwise is motive, will have a place for them. New fibers such as nylon and vinyon had scarcely got started before they were put to war use. Once the war is over they will be with us in greater abundance and at lower cost for a variety of uses so vast and so diverse that we can scarcely imagine them.

And the chemical engineer continues to create and to invent. He meets the challenge of scarcities and shortages with ever new "substitutes" that excel their originals. Even before the war is over he will have placed at our command a hundred new materials which we did not have before. His workshop is all industry. His contributions are as limitless as are our needs.

But right now his all-important job is to help win the war; to fight to a finish the ruthless and resourceful enemies that are devoting all their science and technology to bring about our defeat. So, as we take stock of our assets in this desperate struggle, we count among the first the proved resourcefulness of the research-minded chemical engineers we now have mobilized to help us fight this chemical war.



President, McGraw-Hill Publishing Company, Inc.

This is the fourth of a series of editorials appearing monthly in all McGraw-Hill publications reaching more than one and one-half million readers.

COAL AGE

DEVOTED TO THE OPERATING, TECHNICAL AND BUSINESS PROBLEMS OF THE COAL-MINING INDUSTRY

WAR MAINTENANCE

WHEN a machine is idle as a result of a mechanical or electrical breakdown caused by any one of a number of things, the result is a series of penalties which quickly find their way back to the cost sheet. Production suffers, among other things, meaning that the tonnage over which expenses must be spread is smaller. At the same time, money must be laid out to get the machine back into shape.

These are powerful arguments for keeping equipment in tiptop condition any time. Now, however, winning the war demands that every machine be kept working at the last notch. Good maintenance is the answer, and it usually is less costly than poor maintenance, which removes the last excuse for doing any but the best possible job.

Good maintenance, furthermore, is not too difficult to obtain. Aside from men and materials, it involves system, organization, inspection, records, lubrication and proper methods. Preventing trouble rather than fixing it afterward should be the goal. The good ways are the subject of this "how-to-do-it" issue of *Coal Age*. Numerous equipment manufacturers and coal-mining men contributed ideas and to these grateful acknowledgment is made. In conclusion, the goal of all should be: Keep 'em on the job!

BROKEN OR LOST

AN ASTONISHING quantity of material and equipment, it must be conceded, is broken or lost around the average coal mine. This refers not so much to the big things as to the little, although carelessness or rashness in operation has been known to break even such massive things as a shovel frame, while losing bulky items the size of a bale of steel ties or even larger is not uncommon. But the big things get more attention usually, both before and after, and so the likelihood of breakage or loss is perhaps a little less.

As much cannot be said for the little items in a lot of cases. So such things as breaking castings by throwing drills down on the bottom or leaving stray track spikes and the like to be covered up in the gob go on all too often. A good-sized track spike, it should be remembered, represents enough material to make a hand grenade, and its loss not only takes that much material permanently out of circulation but requires additional labor and material to make a new one to replace it.

More attention to the subject unquestionably is indicated. Education in the value of materials and their place in the war effort seems the first step to take. Perhaps letting supervisors, at least, in on the facts of life as represented by the cost of materials is a good approach. The more new material that is saved, and that includes material necessary to repair broken items, the less the cost to the coal company and the smaller the strain on the manufacturing facilities of the country. Hand in hand should go a comprehensive scrap-saving program. Scrap is ammunition these days, no less than powder. The steel mills need it and no mine will want to feel that it has done less than its share in supplying it.

KEEPING TRACK

THE NECESSITY for adequate records and reports as a means of insuring good equipment condition is suggested time and again in this war-maintenance number of *Coal Age*. Records and reports on all other phases of mining coal are just as essential for maximum efficiency, as no organization can work effectively in the dark. The number and type of the forms and records will vary to suit the needs of the particular operation, so no general standards can be given here beyond saying that they should be easy to fill out and should be designed to supply the desired information with the minimum of difficulty. This leads to the conclusion that it might be worth while for any mining company to check its record and reporting system to see whether the present forms are adequate and whether any new ones should be adopted.

Another type of record might be urged as an extremely worth-while step for any coal-mining operation, namely, an operating manual. Several companies

have found comprehensive safety manuals, with their accompanying operating information, well worth their cost in reduction of injuries and increased efficiency. Now, the Snow Hill Coal Corp., in Indiana, comes forth with an operating manual covering every phase of mining, preparation, safety and related activities at its property. Prepared by the staff at the mine, it gives everybody on the job an invaluable picture of what is going on and how individual activities fit into and influence the over-all results. In the words of A. K. Hert, the general superintendent, the manual not only helps the supervisor of today but also affords an excellent opportunity for passing on "to the foreman of tomorrow information that may be valuable to him and to our company." This example is well worth emulating.

GOLDEN KEY

RESEARCH has been likened by some commentators to a golden key unlocking the treasures of the future. Many industries have found it such. Coal is beginning to sample some of the benefits, which should whet its appetite for more. As each day goes by, the possibilities widen. Study of the statement by A. W. Thorson, of the Carnegie Institute of Technology, and of the briefed down report of the proceedings of the American Chemical Society elsewhere in this issue should supply the inspiration if any now is lacking.

One of the more attractive aspects of increased research is the cushioning effect it could supply in the future. With the industry forcing its pace to meet the demands for its product, there might be a tendency to postpone consideration of a broadened research program. Now, however, is the time to take the steps that will pay off in the future when an extra advantage may be extremely welcome.

RUBBER IN COAL

GROUND for many surmises is provided by H. L. Fisher's statement at the Buffalo meeting of the American Chemical Society that German lignite contains threads of vulcanized rubber. Coal in its many metamorphisms has appeared to have behaved mysteriously like rubber. Thus, low-volatile coal and semi-anthracite always are fragile, but anthracite seems to be the same substance vulcanized by heat into a glasslike substance, an action that conceivably might be utilized in the manufacture of briquets out of fine coal. Significant also may be the fact that high-sulphur coals have a hardness that is almost proverbial. Their sulphur may have vulcanized the rubber which the coal contains.

Lignite is stronger than bituminous coal, but its decline in strength as it increases in rank may be due to loss of moisture and not devulcanization, a reverse action that could hardly be expected. The ability of lignite, in certain sections, to form briquets without binder solely with the aid of heat and pressure may be due to the presence of either resin or rubber or both in the coal. Both resinous and rubber-bearing trees probably are more numerous today than they were in earlier years and more frequent in Cretaceous than in Carboniferous time, though conifers had their place in the latter period. This may account for the readiness with which Cretaceous and Eocene coals briquet without either binder or impact.

"E" FOR COAL

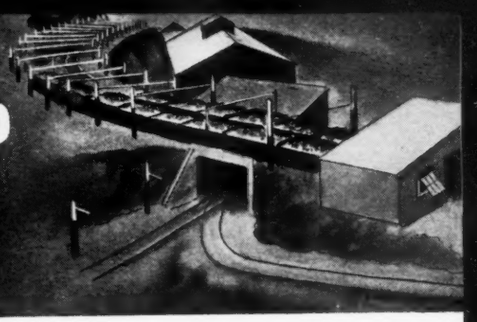
THE LIST of plants flying flags bearing the Army, Navy or Army-Navy "E" for excellence in production daily grows longer. But the list contains few, if any, coal-mining companies, although the coal industry is doing a job and doing it well. Granting that it has few dealings directly with the Army or Navy and thus has little chance of competing for the Army-Navy "E," nevertheless it seems that the industry is deserving of some tangible award from the government and country it so ably serves. Perhaps a special flag from an organization such as the War Production Board would be the answer. The question certainly deserves investigation. Nothing would better spur an organization of supervisors and workers that has done an excellent job on to further accomplishments than a visible recognition of a task well performed flying over the headframe.

MAKE THEM WELCOME

COAL now is enjoying a lot of new business shed by competing fuels and energies, especially oil. But, like all windfalls, this new business should not be held too lightly because too easily gotten. How new customers are treated now will determine whether they will be genuine converts to the advantages of coal or will just bide their time until they can get back to their other love.

R. E. Howe, president, Appalachian Coals, Inc., hit the nail on the head when he made the following statement to the Southeastern Retail Coal Merchants' Association: "Let us treat a new customer converted from oil or gas in such a manner that when conditions change so that it might again be possible for him to use these competing fuels he will have realized the greater advantage of coal, its availability, its dependability and its economy, and will have no desire to give up the use of coal." That goes, it scarcely needs pointing out, for operators as well as retailers.

COAL AGE NEWS ROUNDUP



Fuel-Oil Rationing Set Up for Thirty States; Coal and Oil Movement Upped Still More

Fuel Oil Rationing Set for 30 States Oct. 1—Ban on Oil to Non-Converters Threatened—Oil Deliveries Upped Still More—General Plans for Increasing Coal Output Considered

ANNOUNCEMENT of a card-rationing plan and threats that certain consumers who have failed to convert will not get oil this winter marked developments in the fuel situation in September. Pressure for stocking coal continued and further steps were taken to increase oil deliveries, especially to the East.

Canadian work, as usual, largely paralleled that in the U. S. Pressure to convert where possible was continued, and consumers were urged to delay starting heating furnaces as long as possible. Further restrictions were placed on gas use, such as in the Windsor-London area of Southwestern Ontario, where some 6,000 homes were ordered to convert to coal, according to reports.

Oil Users Granted Fill Up

Economy in the use of all types of fuel also was stressed in this country, the government, in addition to producers and operators' organizations, issuing several bulletins and instruction sheets addressed to that end. The big news, however, was the announcement of the oil-rationing plan on Sept. 15, simultaneously with the ending of the delivery curtailment put into effect some weeks previously. Restrictions on delivery were lifted until Sept. 30 to give consumers an opportunity to build up stocks to not over 275 gal. each, except in the case of other than individual home owners, who were permitted to store 50 percent of capacity.

Announcement of the rationing plan was made by Donald M. Nelson, chairman of the War Production Board. The plan will be administered by the Office of Price Administration. Decision to institute the rationing plan was made by a committee consisting of Price Administrator Leon Henderson, Under-Secretary of War Robert P. Patterson and Acting Petroleum Coordinator Ralph K. Davis. All committee sessions were attended by Mr. Nelson.

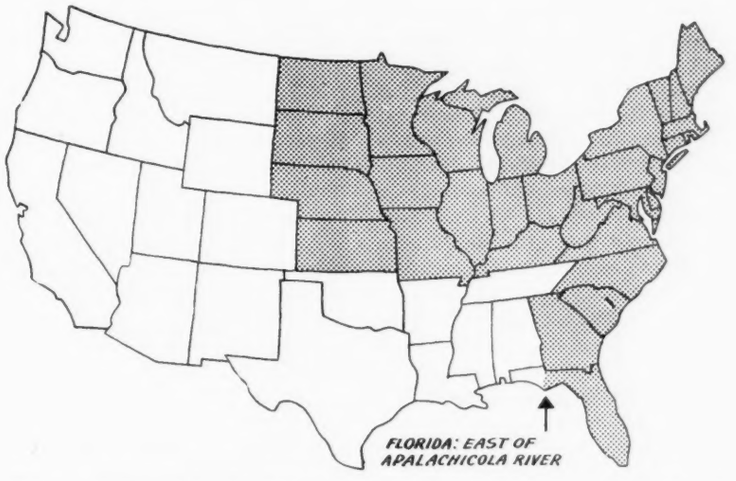
The rationing will be adjusted by localities on the degree-day basis, using a 65-deg. day-time house temperature as the basis. The plan became effective Oct. 1, with the provision that users would promise to surrender the necessary coupons for delivery as soon as they become available. The goal is a cut of 33⅓ percent in the consumption of oil in the rationing area.

Thirty eastern, midwestern and northwestern states and the District of Columbia are included in the rationed area, which takes in more than a third of the country and about three-fourths of the population. Four zones have been set up in this area to take care of climatic variations.

Along with the rationing announcement, Washington also stated emphatically that conversion work must continue and that consumers should give attention to insulation and other heat-retention measures. On Sept. 9, the Washington attitude was made even clearer with an announcement that the OPA policy would be based on complete denial of fuel-oil rations to apartment houses and commercial, industrial and institutional establishments which can convert to coal and fail to do so.

Along with rationing of oil, deliveries of manufactured gas to new industrial and domestic consumers was restricted beginning Sept. 1 in a WPB order (L-174) designed to cope with the gas shortages expected this winter, which are expected to be accentuated by the oil shortage. This order is a companion to L-31, affecting natural and mixed gas, issued last winter.

Attempts to boost oil deliveries to the eastern states continued in September. Tank-car deliveries shattered all previous records in the week ended Sept. 12 with an average of 838,440 bbl. daily. Other measures included ordering increased drilling in Illinois, Indiana and Kentucky; further preparations by the government to absorb the increased cost of oil movement overland; announcement that construction of the trans-Florida pipeline would start Oct. 1; authorization of



This map, released by the Office of War Information, shows states subject to rationing of fuel oil beginning Oct. 1.

a line between Greensboro, N. C., and Richmond, Va.; and announcement Sept. 22 that converted river barges would begin to operate from east Texas and southern Louisiana up the Mississippi and Ohio within 60 days.

Although stating that the summer buying campaign had yielded good results, government agencies and operators continued pressure to fill in the gaps in coal reserves against a possible pinch later on.

General plans for increasing coal output were reported under consideration last month. These were said to include opening new mines and increasing the quantity of machinery available, including a request to WPB for allocation of the necessary materials.

Work on Halting Manpower Inroads Stepped Up; Metal Miners and Lumber Workers "Frozen"

Coal Manpower Committee Embarks on Its Duties—Western Metal Miners and Lumbermen "Frozen" in Jobs by McNutt—Miners and Operators Continue Efforts to Cut Absenteeism and Raise Output

WHILE COAL operators continued their efforts to obtain government assistance in retaining essential employees and both operators and miners pressed their victory-production campaigns, September was marked by perhaps the first attempt to prevent pirating and departure of employees from industry, in this case metal mining and lumbering in the Far West. Meanwhile, agitation for a national-service law for workers to permit better control of the labor supply increased. In fact, according to Manpower Commissioner McNutt, such legislation has been under consideration for some time by his agency.

Attempts to meet the situation in coal mining headed up in the new Subcommittee on Manpower of the Solid Fuels Advisory War Council (September *Coal Age*, pp. 40, 96). This group met with General Hershey, Selective Service Director, and General McSherry, of the War Manpower Commission, last month. One upshot was a promise by General Hershey that draft boards would be advised that protection of coal-mining manpower is essential and that the regulations covering such deferment should be carefully followed. At the same time he advised operators that requests for deferment should stress the importance of the employee in maintaining coal production.

Meetings with General McSherry brought a promise that causes of migration of coal miners to other industries would be carefully studied, accompanied by a request that operators furnish pertinent information to T. J. Thomas in the Office of the Solid Fuels Coordinator.

Twelve western states were declared a "critical labor area" by Manpower Commissioner McNutt on Sept. 8. This step was taken to halt the loss of men from the lumbering and metal-mining industries. Except under certain specified conditions, workers in these industries may not switch to other jobs, nor may employers in these industries release workers for other jobs without first obtaining a certificate of separation from the U. S. Employment Service. Furthermore, the rule was laid down that no employer in the area, whether engaged in essential or non-essential production, could hire any worker from the designated industries on or after Sept. 7 without the separation certificate.

Operators, miners and government authorities continued their campaigns for steady work and no layoffs in anthracite and bituminous mines in September, which also was marked by a suggestion by General Hershey that victory production committees bring slackers to the attention of their local boards. Deferment, he said, is not for those who do not work full time.

Awards, rallies and other morale-promoting measures featured activities last month. In northern West Virginia, for example, better production was pledged at a "victory dinner" tendered to heads of the production committees, meetings were held at various mines and a system of awarding buttons to top production crews and men at each mine was set up.

Western Pennsylvania developments were featured by a meeting of members of the labor-management committees of the Pittsburgh Coal Co., in conjunction with members of the safety committees at Washington, Pa., to hear both company and union officials outline objectives for more and better-quality tonnage. Other speakers included representatives of the U. S. Maritime Commission and the War Production Board.

Colorado, eastern Kentucky, Illinois and other bituminous regions also stepped up their efforts, while operators in eastern Ohio asserted that some 800 men were needed and asked for more consideration of the region's difficulties from draft boards.

Anthracite was the subject of more concentrated attention in September, including a suggestion that the industry go on a six-days-per-week schedule. The War Production Board announced Sept. 4 that several new mines and collieries had formed victory production committees, bringing to more than 100 the number participating in the drive. Later in the month, Donald M. Nelson, WPB chairman, announced four big Army-Navy production rallies for Scranton, Hazleton, and Pottsville, Sept. 28, 29 and 30 and Oct. 1. The program was sponsored by the Anthracite War Production Committee composed of Mart F. Brennan, for the union; Frank W. Earnest Jr., for the operators; and Richard Maize, Pennsylvania Secretary of Mines.

While under consideration, no action was taken on the six-day week for hard coal. Requests for wage increases continued. The sum of $2 a day was set in a resolution adopted at the biennial convention of District 9, Sept. 17.

Longer Work Week Asked

An increase in the present working schedule of 35 hours per week was asked by Fuel Coordinator Ickes at a meeting of operator and mine union representatives called in Washington, D. C., Sept. 28. This increase in working time is necessary to meet possible demands for 600,000,000 tons of bituminous coal and 60,000,000 tons of anthracite in 1942, said Mr. Ickes. John L. Lewis, United Mine Workers head, doubted the need for a longer week and in any event contended that he would have no authority to deal with the problem until after the union convention beginning Oct. 6. The conference also disagreed on whether to settle the problem on an industry-wide basis or by districts. The result was no decision, beyond an expression of willingness to meet further in the future.

New Minimum Bituminous Prices Established: Average Increase for the Nation 15.53c.

THE FIRST general revision of minimum bituminous coal prices, reflecting newly established costs, was ordered by Dan H. Wheeler, director, Bituminous Coal Division, in September. The order provides for regional increases ranging from 5 to 30c. per ton, making the weighted average increase for the nation 15.53c. per ton. The new prices went into effect Oct. 1, 1942. A return only 1.7c. less than the weighted average cost is anticipated for the country as whole. The return by price areas is as follows:

Price Area	Increased Realization Necessary, Cents	Weighted Average per Ton Increase, Cents	Difference, Cents
1.....	19.13	18.53	—0.60
2.....	1.92	5.24	3.32
3.....	31.03	28.30	—2.73
4.....	37.54	33.45	—4.09
5.....	6.73	7.29	0.56
6.....	13.50	14.51	1.01
7.....	3.75	6.04	2.29
9.....	14.43	15.00	0.57
10.....	30.60	26.37	—4.23
Average.	17.23	15.53	—1.70

Increases above the original minimum-price schedules, by general consuming regions, were as follows:

1. The eastern seaboard as far west as and including Michigan (except the upper Peninsula), thence south along the Indiana and Ohio State lines, through the center of Kentucky and Tennessee and south along the Alabama and Georgia State lines, and eastern Canada .....20c.

2. Greater Chicago and its switching limits; greater Louisville; Indiana, except west central and southwest portions; western Kentucky, Tennessee and Mississippi; Arkansas, Louisiana and the greater portion of Missouri, excluding St. Louis.....10c.

3. Wisconsin, Minnesota, Upper Michigan Peninsula; North and South Dakota except a small portion of southwest South Dakota; Montana .....15c.

4. West and south central Indiana, all Illinois except greater Chicago, Iowa, small eastern portion of Missouri, including St. Louis.....5c.

5. Alabama, eastern Tennessee and Mississippi, certain areas in west central Georgia, Florida.....30c.

6. Wyoming, Utah, Idaho, Oregon, Nevada, California and the Black Hills region of South Dakota.....5c.

7. Nebraska, Kansas, Oklahoma and Texas (except west central)....10c.

9. Colorado, Arizona, New Mexico, west central Texas.....15c.

10. Washington, Alaska, western Canada .....25c.

Exceptions were made in prices for locomotive fuel, fuel for certain other purposes and coal shipped by truck and certain forms of transportation other than by rail. By producing districts, the increases were:

Nos. 1, 2, 3 and 4—Railroad fuel other than that shipped via the Great Lakes as cargo; bunker and vessel fuel; truck shipments.....20c.

No. 5—Railroad fuel, truck shipments .....20c.

No. 6—Railroad fuel, other than shipped on the Great Lakes as cargo; vessel fuel; truck shipments.....20c.

Nos. 7 and 8—Railroad locomotive fuel and other low-volatile on-line railroad fuel (except that shipped via the Great Lakes as cargo); bunker and vessel fuel; truck shipments.....20c.

Nos. 9, 10, 11 and 12—Railroad locomotive fuel, no increase; truck shipments .....5c.

No. 13—Railroad and powerhouse fuel, Subdistrict 1; railroad fuel, Subdistrict 3; all vessel fuel; truck shipments .....30c.

No. 14—Railroad locomotive fuel, 40c.; truck shipments.....30c.

No. 15—Railroad locomotive fuel, 5c; truck shipments.....10c.

Nos. 16 and 17—Railroad locomotive fuel; truck and wagon shipments .....15c.

No. 18—Engine coal between 8 and ½ in.; truck or wagon shipments..15c.

Nos. 19 and 20—Railroad locomotive fuel; truck and wagon shipments .....5c.

No. 22—Railroad locomotive fuel, Subdistricts 1 and 7; all railroad fuel, Subdistricts 2 and 3; truck and wagon shipments .....15c.

No. 23—Railroad locomotive fuel, 30c.; truck and wagon shipments.25c.

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NLRB Finds for Officials' Union; Organization Campaign Planned

The Mine Officials' Union of America was certified as the proper collective bargaining agency to represent assistant foremen, firebosses, weighbosses and coal inspectors at three mines of the Union Collieries Co., in western Pennsylvania, in a 2 to 1 supplemental opinion in Docket R-3464, released Sept. 19 by the National Labor Relations Board. Foremen and night bosses, however, were excluded from the union jurisdiction. Gerard D. Reilly dissented from the majority opinion of Harry A. Millis and William H. Leiserson, which rejected representations by various operators' associations and the Commonwealth of Pennsylvania.

Following the board ruling, John McAlpine, president of the union, announced a program under which it proposes to demand bargaining agency rights at all coal mines in the United States.

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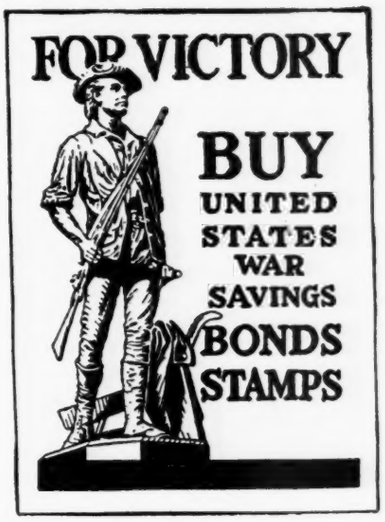

Better Home Heating Program Hits Its Stride

With its educational program well under way, Better Home Heating, Inc., organized last year in Minneapolis and St. Paul, Minn., is concentrating on other activities, particularly on conversion to oil, where possible, of many plants in the Twin Cities now burning coal. As set forth in the organization's pledge, its purpose is to provide customers with expert advice for the solution of their heating problems, and with the kind of fuel and service that will enable the user to enjoy the utmost in heating comfort and satisfaction with the least possible cost.

Leading dock operators, all-rail shippers and retail coal merchants completed formation of the organization last December after a careful survey had disclosed that solid-fuel suppliers in the Twin Cities had lost nearly half

of their tonnage to competing fuels in the last decade or so. Its program covers education, advertising, publicity and fuel consumer service.

A full-time managing director and staff are functioning and committees have been set up to direct various phases of the program. Newspaper advertising, begun in the summer, will continue indefinitely, with the leading Twin Cities daily newspaper being used, as well as such specialized journals as the labor papers and local neighborhood newspapers. Also an engineering committee, including leading Northwestern engineers, has formulated a short course in combustion, solid fuels and heating. Classes under the direction of the committee are being held weekly.

Officers of Better Home Heating, Inc., are: president, A. J. Chouinard, executive vice president, Carnegie Dock & Fuel Co.; treasurer, J. H. Macoubrey, chairman of the board, Northwestern Fuel Co.; secretary, Richard Relf, vice president, M. A. Hanna Co.; managing director, O. E. Steele.

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Britain Expects Coal Crisis; Control to be Continued

With production falling, Great Britain is expected to meet a coal crisis this coming winter, which may be accentuated in 1943, according to reports. Failure to adopt government-enforced rationing, it is declared, will add to the problems in the coming months. As an attempt to alleviate the shortage, the government has announced that a bonus of 1 percent will be paid miners for production in excess of the official standard of 217,006,400 tons annually. The bonus also is expected to allay a rising tide of dissatisfaction among mine workers faced with the disparity of their earnings compared with those of munitions workers and the like.

A permanent status is foreseen for the coal-control plan adopted in Great Britain earlier this year (August *Coal Age*, p. 46). This future was predicted by Major Gwilym Lloyd George, the new Minister of Fuel, in a speech Sept. 21. Pleading for consumer cooperation to help in the present shortage, Major George stated that "the Ministry is not here on a temporary basis. . . . It has taken a war to get a Ministry which many people thought long overdue. Let us see that what war made us create, peace will not allow us to forget."

Coal Research Offers Many Possibilities, Says A. W. Thorson, Carnegie Institute

Post-War Slump Can Be Alleviated by Research—Present Program Constitutes a Good Start, But Should Be Expanded — Plastics, Chemicals, Dustproofing Mediums, Fuel and Carbon Are Prospects

"WHAT DOES the future hold for me and my business?" asks A. W. Thorson, Carnegie Institute of Technology in a statement on research possibilities. "That is a question every business man is asking himself these days. Land owners and operating and sales executives in the coal industry in particular are pondering this problem. Many will recall the varying fortunes of the industry during and after World War I, and wonder if history will repeat itself.

"History need not repeat itself because 'The Lord helps those who help themselves.' In 1933, a representative group of coal producers decided to help themselves and the industry by turning, as most industries have done, to research, starting on a big job that needed doing badly but that no one company felt justified in tackling on a broad basis. Bituminous Coal Research, Inc., was formed and it went to work.

Combustion First Job

"Funds were raised from coal producers and coal carriers and the Battelle Memorial Institute, Columbus, Ohio, was selected as the laboratory. A program was organized to apply present knowledge and current new ideas to improve domestic and industrial combustion equipment. This was the first official recognition by the industry of its obligation to provide proper apparatus for the best use of its product. The best mining and preparation goes for naught if the product is improperly consumed. Progress and results of this program are now well known. Equipment manufacturers are keeping informed of progress and the present lull in manufacture of civilian goods presents an opportunity to apply new designs and to be ready to market the improved equipment when manufacture is again resumed.

"In addition to its contribution to the Battelle program, the National Coal Association, through Bituminous Coal Research, Inc., is contributing to the coal research laboratory at the Carnegie Institute of Technology. It has joined twenty-five leading coal producers, coal carriers and steel and chemical companies, together with Carnegie Institute of Technology itself, in carrying out a long range fundamental research program. This activity, now twelve years old, was designed to develop basic knowledge on the chemical nature of coal and on the processes of combustion, carbonization and liquefaction of coal. These studies should lead to improvement in the present uses of coal as well as to development of new chemical uses. The coal industry has officially recognized the importance and value of this fundamental attack as an essential part of a well rounded research program. This is a sound policy and conforms with good research practice in other industries.

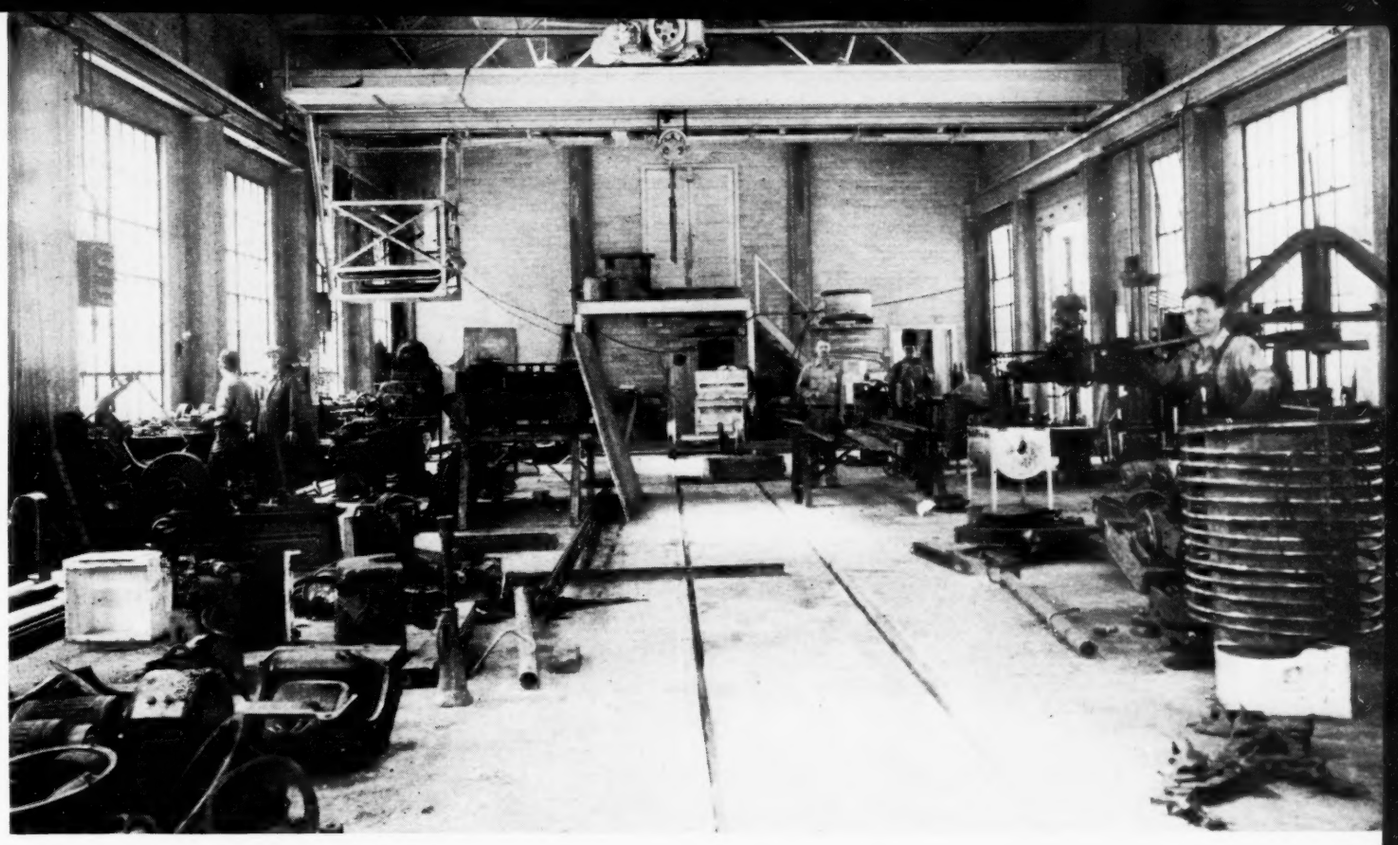
Start Made But More Needed

"Thus the industry has a good start toward insuring its future. But let's remember it's only a start and must be expanded many-fold, soon. Why? Let's look ahead.

"The well-known economist, Roger W. Babson, in a syndicated article published May 30, 1942, says: 'New industries led by plastics and chemicals have a great future. . . . and in event of a post-war slump in other lines can again put us on our feet.' Plastics and chemicals! Coal! One and the same if the coal industry wills it. The chemical industry has not in the past been a quantity market for coal. The chemist was talking pounds. Now he is talking tons. Plastics, synthetic rubber and others are expected to require hundreds of thousands of tons of raw materials annually. Practically the only sources of such quantity supply are coal, petroleum and possibly alcohol from farm products. The coal industry can have its share of these markets or not, depending on the amount of preparatory research it is willing to do. Let us examine some of the possibilities.

Benzene—Benzene is a coke-oven byproduct used as a bulk chemical for many years. Much of our huge synthetic rubber program depends on it. The Buna-type rubber is made by combining the two chemicals, butadiene and styrene. Styrene is now made from benzene and butadiene possibly

(*Turn to page 174*)



For efficient low-cost maintenance, good shops are essential.

WAR MAINTENANCE

Good Maintenance and Efficiency Go Together—System the Keynote—Attitude, Organization and Personnel First Points of Attack—Ample Supplies and Repair Facilities Essential—Inspection and Lubrication Vital

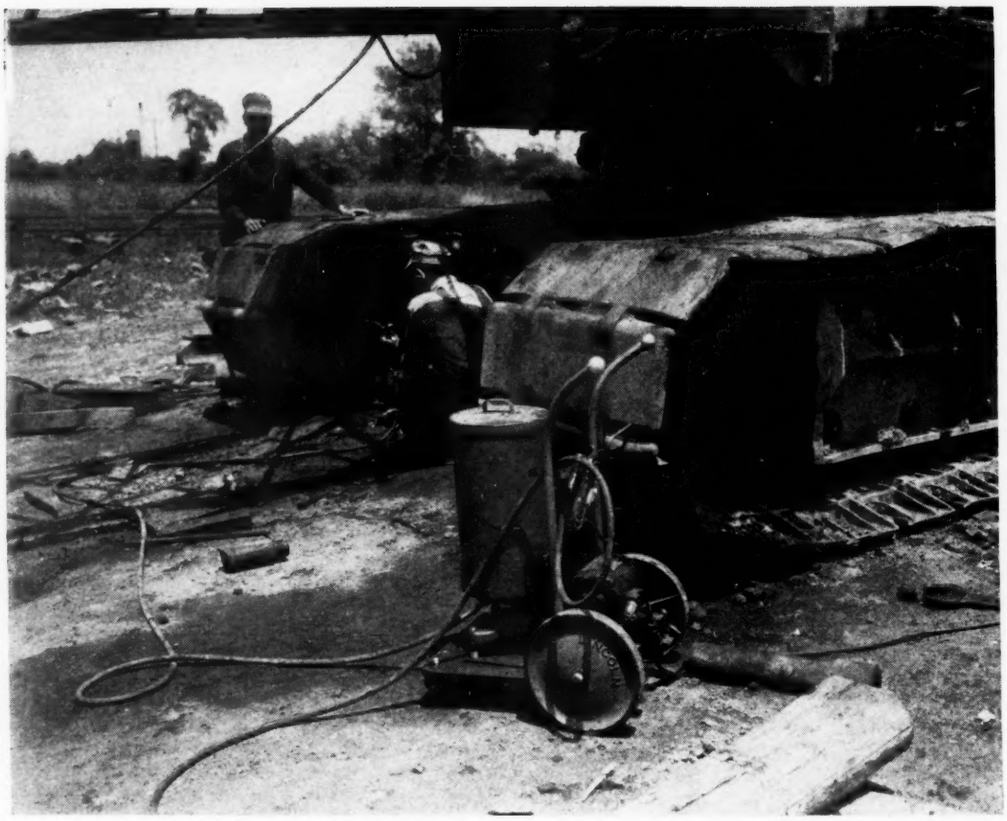
WHAT is maintenance? According to Webster's dictionary, "maintain" means "to hold or keep in any particular state or condition, especially in a state of efficiency or validity." The term "efficiency" is the crux of the matter in coal-mining under wartime conditions, although good maintenance naturally is a desirable goal at any time. But with war making both materials and men scarce and throwing a heavier burden on the industry for tonnage, keeping machines running and holding a state of efficiency become even more vital.

Equipment maintained in tiptop condition not only eliminates delays from breakdowns but also renders invalid one of the most overworked excuses for low production. Proper maintenance is an outstanding factor in creating and holding a proper attitude among equipment operators. A major byproduct is safety, which always accompanies the increased efficiency growing out of proper maintenance standards and methods. Because good maintenance involves exact methods of checking and maintaining lubrication and requires an inspection system capable of nipping troubles in the bud, its actual cost can be lower than the cost of indifferent or bad maintenance.

System is the keynote for any job and applies in full force to maintenance work, whether it be in a mine using only two loading machines or two conveyors or an operation using 30 loading machines or numerous conveyors. Even in the small mine, if lubrication and inspection are not handled systematically, equipment, production and cost will suffer. Written reports and records may not be necessary at the small property where only one man is responsible for all the details, but at larger operations they constitute the only sure method by which superiors can put their fingers on weak spots in the maintenance set-up, as well as on operating conditions that may be responsible for extra difficulties in keeping equipment operating efficiently.

Specific data on many of the problems connected with the maintenance of the various machines and facilities used in coal production are the subject of the following articles in this war number of *Coal Age*. In this material, it will be noted, there are a number of recurrent themes, all of which are marks of good maintenance programs. These might be summarized as follows:

1. Attitude — Good maintenance cannot be obtained unless the management understands what it is and is sincerely desirous of having its benefits. It is necessary that management appreciate the dollars and cents aspects. If the cost of maintaining a loading machine is reduced from 8 to 5c. per ton and the better condition of the



One major preventive measure—proper lubrication.

machine makes it possible to raise production from an average of 250 to 300 tons per shift, it is evident that the savings will much more than offset the increased cost.

2. *Organization*—Hit-or-miss methods are not conducive to good maintenance. The problem should be thoroughly studied and an organization and system set up to do the job efficiently, safely and at the lowest possible cost.

3. *Trained Men* — Without men who know their business, no maintenance program can produce the best results. The demand for such men is growing while the supply is decreasing. It therefore follows that schooling to fill the gaps should be a continuous activity at coal mines.

4. *Records and Reports*—No organization can work in the dark and consequently some system of reporting on machine condition, work needed and repairs accomplished is a necessity. The form of reporting may be varied to suit the operation and the equipment used, but reports of some kind are essential.

5. *Inspection and Lubrication*—Preventive measures should take first place in maintenance work, rather than fixing equipment afterward. Regular inspection of equipment condition therefore is an essential, along with correct lubrication. A few cents' worth of oil or grease applied at the right time may save hundreds of dollars in damage.

6. *Parts and Materials* — Maintenance programs must be supported by an adequate supply of parts and materials to meet normal day-to-day demands. Equally important, these supplies should be at points where they are likely to be needed, whether on the surface or underground, and storing should be adjusted accordingly. And one of the duties of the responsible man or men should be keeping up with new materials which will increase machine life.

7. *Ample Shop Facilities*—When repairs and overhauls are necessary, adequate shop facilities should be available. Shop location and equipment will vary with mines and conditions, but attention should be given to providing some repair facilities near the working sections in most operations.

8. *Tools*—The tool question often is not given the attention it deserves. Both shop and hand tools should be ample in quantity and right in type And it should be noted also that they cover a wide range of items. Rerailers, rail punches and the like are just as much tools as wrenches, screwdrivers and drills, and having them on hand at the right time may save many dollars.

It should not be forgotten, also, that tools themselves need care and maintenance. Rail benders and lifting jacks, for example, should be inspected, cleaned and lubricated at regular intervals. Overloading should be avoided. Small electric drills, grinders, nut runners, etc., should have the same or even better care than larger production equipment.

9. *Cleanliness*—Keeping equipment clean and in clean surroundings is another major maintenance factor too often neglected.

10. *Surface Protection*—"Save the surface and you save all" might well be the theme in many coal-mining applications. Surface savers include not only paint and similar coverings but also special protective coatings for metal, concrete, wood and other materials. Added to surface protection is impregnating wood with preservatives to lengthen its life.

DEEP-MINE ORGANIZATION

Organization and Personnel Both Influence Maintenance —Organization Set-up Varies With Size of Mine—Training of Men Now More Vital Than Ever—Alternatives Are Job-Training on the Job and Class Training Elsewhere.

COAL-MINE maintenance naturally involves both organization and personnel. Organization set-ups at deep operations vary widely, reflecting principally the early trainings and experiences of officials from the manager or superintendent down to the chief electrician and/or master mechanic. A number, however, are widely employed, and will be analyzed in the following material.

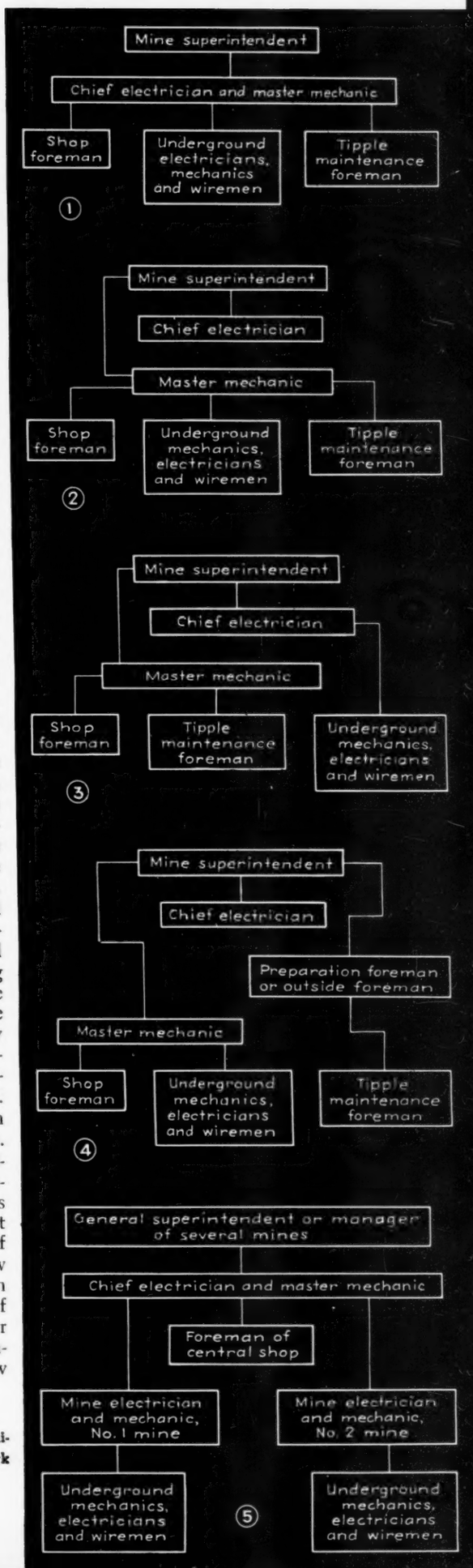
For the typical middle-sized deep mine, Chart No. 1 outlines an effective maintenance organization. One of its virtues is that no attempt is made to separate electrical and mechanical work, which in mining are so intertwined that separation often brings complications leading to increased overhead. In this set-up, the man in charge should be, as the chart implies, thoroughly experienced in both electrical and mechanical maintenance. Lacking such a man, the organization shown in Chart No. 2 is recommended. Here the chief electrician is in direct charge of all outside electrical distribution and power, perhaps also inside substations, and in addition acts as a consultant on many underground equipment maintenance problems.

Chart No. 3 illustrates a successful variation wherein the master mechanic's activities are largely confined to the topworks, principally the preparation plant and shop, assuming that the general shop is located above ground. Under this set-up, the chief electrician is directly responsible for underground maintenance. He may have his headquarters underground and be called to the surface only when needed. If there is available an outside foreman or preparation foreman (Chart No. 4) the tipple maintenance may be shunted around the chief electrician and/or master mechanic.

For a company operating two or more mines not too distantly separated, Chart No. 5 illustrates an organization wherein one man termed "chief electrician and master mechanic" or perhaps "superintendent of maintenance" or "division superintendent of maintenance" coordinates all the work, including supervision over a central shop serving the two or more mines. The man of technical training and broad experience serving as the equivalent of chief electrician and master mechanic often is given the company title of electrical engineer or, to suit certain cases, mechanical engineer, electrical and mechanical engineer, or chief engineer.

For simplicity, the general mine foreman has not been included in the charts, yet he enters directly into the picture. Safety considerations demand that technically, at least, the underground maintenance men take orders directly or indirectly from him. This problem is successfully solved by promulgating a thorough understanding that orders from the general mine foreman go and by arranging things so that the general mine foreman can leave maintenance to competent men, even though they get most of their orders from the outside, with necessary supplemental instructions from the foreman himself.

No organization works without men of proper training and broad ideas. Therefore, personnel training is equally as important as organization. Together with training in fundamentals and technique, maintenance men must be imbued with the importance of thoroughness and dependability. A few companies in the past have given adequate attention to the training of men not too likely to jump to other jobs and are not now seriously confronted with the problem of too few



Typical maintenance organizations in coal-mining work

and a time shortage for training others. Some, before the draft was imminent, may possibly have acted on a hunch that the younger men without dependents might be called for military service.

Not as long as this war lasts is it too late to begin training the more stable men for mine maintenance jobs. Vocational extension courses, which have been successful in many states, need the fullest encouragement by cooperation, loan of equipment, space for classrooms and so on. Maintenance men who have been graduated from thorough courses have spotlighted the possible benefits by cutting equipment failures to less than half the former average. Superintendents and foremen who have attended the classes gain respect for equipment and for the maintenance man's problems, all adding up to closer cooperation.

Two general plans get results: job-training on the job and class-training off the job. Better still is to put both into effect. A class is far the best for instilling the principles of thoroughness, system and reliability and is the cheapest and quickest way of teaching certain fundamentals; for instance, in electricity, the basic relations between voltage, current and resistance; and in mechanics, the expansion, warping and inherent change due to heating.

Obviously, the hiring of a new man suited for class instruction and job-training in maintenance is a remote possibility these days, so the instructor must be found or made on the job. In numerous cases the chief electrician and/or master mechanic is capable but needs the encouragement of the higher officials. An ingenious management can find inducements which will return the cost many times.

System is the beginning and soon becomes the heart of job-training. First, the best way to do a maintenance job from the standpoints of reliability, safety, ease and cost must be found by observation, study and experiment. Then, and highly important, an adequate description of that method must be put down in black and white for direct use by the workman or as a guide for the job trainer or supervising boss. As a valuable by-product, study to determine the best way often suggests a new tool or gadget with which to do the job better or quicker.

Job-training on the job, where a special instructor is not available, can be done effectively on a hand-down or pass-along basis, all under the general guidance and supervision of the chief electrician or other maintenance head. When one man has been taught to do a certain job in the established way, he in turn must be induced to pass his experience on to another. That job of creating an incentive for the workman to cooperate in this educational process, of course, is a problem that challenges the manager or personnel director.

RECORDS AND REPORTS

Equipment Records Are First Line of Defense in Maintenance Work—Records of Failures and Running-Repair Jobs Essential—Service Records Help in Overhauling and Replacement—Job Reports Help in Large Shops

WHEN the electrician at a certain small mine stopped in at the office one day one of his objects was to tell the superintendent he doubted if the pinion on an underground hoist would last more than a shift or two. When confronted with "Let's order one right now by phone. Do you have the dope?" this slightly greasy individual pulled out a notebook in which, in pencil, was recorded the nameplates of each item of equipment used at the mine plus accumulated data pertaining to maintenance. The pinion was correctly ordered that afternoon and received two days later just in time to avert a shutdown. A neighboring mine with a somewhat similar problem was not so fortunate. A day was lost because the data on an underground equipment item were not recorded and a repair-part order was delayed due to having to send into the mine for the information, which was received incomplete, necessitating a second trip!

Equipment records, as epitomized in simple form by that electrician's notebook, are the first line of defense in maintenance at any mine. As mine size increases, more and more records become necessary. Records of machine difficulties are made by the operators or section foremen and left for the repairman. Records of maintenance delays, including causes, are made for the superintendent. If equipment inspectors are employed, their findings should be recorded. For cost analysis, records of parts applied and labor cost become necessary. In records, as in other things, there is a happy medium. It goes without saying that every record that more than saves its cost is worth keeping. Adding any record or report that requires permanent employment of an extra clerk deserves very close scrutiny.

Making a record of installed machinery in a short time from scratch at a large fully mechanical mine, of course, is a job requiring special help. But it is worth it. The better way is to spread preparation of the record over a period of months so it can be done as a "between rushes" job. Except for the very small mine, the record should be a card or loose-leaf. If a card is used, it should be 5x7 in. or larger instead of 2x4 in. Better results usually follow using 8½x11-in. forms of bond paper punched for a looseleaf binder. These records can be worked up in a typewriter, copies made if necessary and, by using both sides, there is ample space for nameplate data, specifications and later notations of changes in design or other information that will come in handy in maintenance.

Still another advantage of the large-sized loose-leaf sheet is that it allows large writing and is more easily made up by handwriting where maintenance men make up the record without clerical help. If an original and two copies are made, the chief electrician may have one, the superintendent or chief

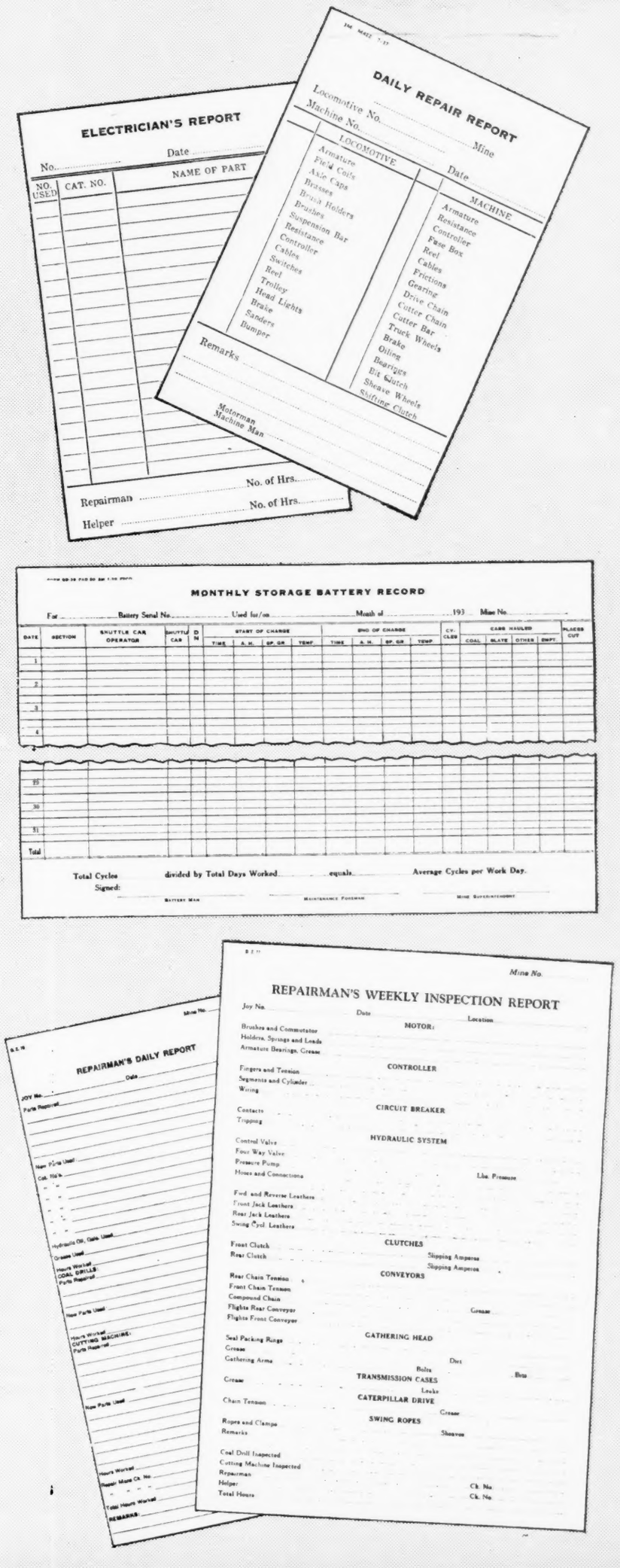
engineer another, and perhaps the purchasing agent or accounting department the third. In place of the metal plate of brass or other noncorrosive material carrying the coal company record number and attached by drive screws, "duration" methods, such as arcweld beads or painted numbers, are recommended.

Working out a sufficiently simple and low-cost system of maintenance cost accounting which will permit keeping tab on each machine seldom is possible. By lumping the costs into types—for instance, drills, cutters, loaders, shuttle cars, locomotives and so on—the material costs are compiled simply from warehouse disbursement records. So that the maintenance labor costs can be allocated, however, it is necessary for the workmen to make out timecards accounting for their hours or for the foreman to furnish that information each day. These material and labor maintenance costs for a class of equipment (loading machines, for example) provide a check on abuses, maintenance efficiency and on other operating considerations.

Records Help in Maintenance

For many reasons the man in charge of maintenance should have a record of all failures and running repair jobs done each day. How simply this can be accomplished is illustrated by the case of a close-together group of large mines with highly standardized equipment. Every morning the chief of underground maintenance, before leaving his headquarters in the central shop, phones each mine electrician and lists on a plain sheet of paper the troubles encountered the previous day. At the end of each month he goes through the 20 or so sheets for each mine and lists the failures under each classification, such as "Locomotive Resistance Open, 5," or "Cutting Machine Clutch Lever Broken, 3." The repeaters are attacked by checking into the operating conditions, investigating the machine operator or working out a better design or a guard for a particular part.

Periodic inspections are indispensable, for that is the only way to catch impending troubles in the "one-stitch" stage. Where the inspections are made by the men who do the repairing—a system of much merit, especially on permissible equipment – inspection forms are not a necessity. In such case it suffices to have a job-training sheet, which helps the man become familiar with the routine. It is ad-



Examples of helpful inspection and repair reports: 1—two sides of a double-faced form, one side for operator's trouble report and the other for repair work; 2—shuttle-car-battery maintenance record; 3—daily and weekly reports at a large mine.

visable, however, that when the machine has been gone over and running adjustments or repairs have been made, the mechanic or electrician put a check mark on a printed card opposite each item he was supposed to inspect. By this he may be reminded of an omission.

Delegating both inspection and repair saves the time for an extra opening and closing of compartments or removing covers and guards, which, on the electrical parts of permissible equipment, is quite an item. On such equipment, however, a separate inspection by a different individual after a machine has been repaired and is supposed to be ready to go back into service is essential as a check on maintenance of permissibility. Records of inspections affecting safety should be made and signed by the individual.

Service records are essential on many items of equipment. When to give a loading machine a general overhaul, for instance, may be based on: (1) shifts worked, (2) tonnage loaded, (3) maintenance delays or (4) inspection of general condition. The first three depend on records, which normally should be available from section foremen's reports.

Wire rope is an example of an item where life records are highly essential to: (1) help determine when a rope should be renewed; (2) determine the design and quality of rope best suited to the duty; (3) serve as a guide in improving conditions under which the rope works, and (4) point the way to the best method of lubrication.

In central shops large enough to employ, say, twenty or more men, a job order system becomes almost imperative for keeping costs and maintaining efficiency. The clerical work can be handled by the timekeeper. A locomotive coming in for a rebuilding or modernization job, a cutting-machine armature for rewinding or any similar job should be assigned a shop, or job, number with a corresponding accounting sheet in the office file and a tag with the number attached to the item. It often is advantageous to include on the tag other information such as number or name of the mine from which the item came and date to be finished if it is a rush job. Such additional information enables the foreman to identify the material more readily.

DEEP-MINE SHOPS

Proximity to Commercial Shops Influences Mine Facilities —Rewinding and Manufacturing Need Careful Study— Welding Equipment Essential—Shops for Running Repairs Should Be Underground, With Car Shops Outside

IMPROVED highways, among other things, have played a part in the present shop picture at deep mines. Such highways encouraged the opening of commercial repair shops and enabled many to install modern tools so that numerous mines, even in the medium-sized class, do very well without electrical winding facilities and machine tools. Maintenance costs at such operations have been favorable, but, now that reclamation has become important, many of them would be more fortunate if they were in the large group of medium- and large-sized mines operating shops with machine tools because they are too distant from a commercial shop or have so much work that a modern shop is an unquestioned necessity.

In addition to proximity to a commercial shop, a mine's need for a repair shop is influenced by number of equipment units in service, types of equipment, natural conditions (favorable or unfavorable) and the ability, training and experience of the maintenance men available to use the shop equipment. About the same factors influence the advisability of including in a shop facilities for doing electrical rewinding, which is more of a specialty than machine-tool work. Of all shop facilities, those for electrical winding are likely to be the least profitable.

Advantages no doubt do accrue to the groups of affiliated close-together mines with electrical rewinding departments in the central shops, but in the case of single mines, especially operations of only medium size, electrical winding pays only when the company is fortunate enough to have an employee who, along with his other duties, is truly an expert in doing or supervising rewinding and who is the type that becomes a fixture on the job.

Only a few of the very largest shops are justified in owning equipment to make complete armature coils. It takes special forms, presses, dipping and baking equipment to do a real job. If factory coils are purchased and winding only is done at the mine shop, the greatest lack usually is in banding equipment for quick, efficient work.

Loose bands are an outstanding cause of trouble on d.c. armatures, and tight bands are difficult to apply with some types of lathes, especially when using certain inferior types of tension blocks. An electrical control which keeps a torque on the armature when stopped and a tension device not affected by wire diameter or heat are great helps. Harking back to the early days, banding by the pulley-and-weight method (*Coal Age*, July, 1937, p. 329), which requires only a stand with low-friction bearings, is unexcelled for bringing the coils gently down to a compact group, finishing with bands of uniform tension.

Only in the central shops serving very large groups of mines are manufacturing facilities justified; for example, gear-cutting machines and equipment for casting and finishing centrifugal-pump parts. Making journals and shafts, however, usually is justified manufacturing because machinists and lathe equipment are necessary for many repair and rebuilding jobs.

Welding facilities are deserving of attention in any shop today. As far as possible, this work should be done in a separate building with ample floor space, crane lifting and handling facilities, and adequately curtained booths. With several welders working in the same room, heat and fumes should be

exhausted by a blower and branch pipes to each booth (*Coal Age*, May, 1940, p. 62). Welding machines should have ample capacity to handle the largest electrode practicable for the class of work. Automatic welding heads for wheel-and-tire filling pay if there is enough work of that type to keep the machine busy one or two shifts per day.

Reports indicate that a new tool, the metal sprayer, would pay in most central shops. Its field of application, and likewise that of welding, are treated in a separate article (p. 113).

Before a machine is brought into a shop for overhaul it should be cleaned. Locomotives, cutters and other large units can be cleaned outside by jets of high-pressure air or a steam cleaner. Smaller items, including units and assemblies for mining machinery, may be cleaned in a special room for the purpose tightly partitioned off from the main room. Blower ventilation should be supplied for this room to remove the dust and fumes from chemical or heat cleaning.

Central shops may be best answer for large operations or groups of mines.

Tools and Space Necessary

Drill presses, shapers, planers, grinders, wheel presses, bit sharpeners, power saws, lathes and, above all, adequate crane facilities are necessities in a central shop worthy of the name. Space required, especially in the erecting shop, is dependent upon whether whole machines are transported there for rebuilding or if only the units or assemblies are handled. Plenty of space, good light and adequate heating and ventilation go a long way toward efficiency and good workmanship.

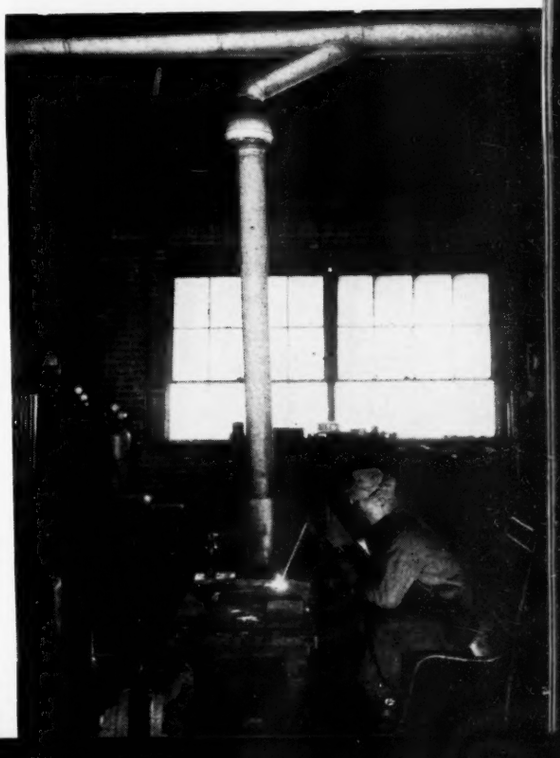
The central shop, in most cases, should be a complete-service unit so that the individual mines need no machine tools such as lathes, shapers and planers. This saves multiplying investment and skilled labor. The individual mine then needs only facilities for making running repairs and installing on the machines the units which have been rebuilt in the central shop.

At shaft mines, shops for the running repairs and unit replacements are of necessity usually situated underground. Near the shaft bottom is the proper place for such a shop until, in later stages, the production is concentrated at one side and perhaps 2 to 4 miles from the shaft bottom. Ventilation usually calls for an airshaft back at that point, and near this shaft is a good place for the underground shop.

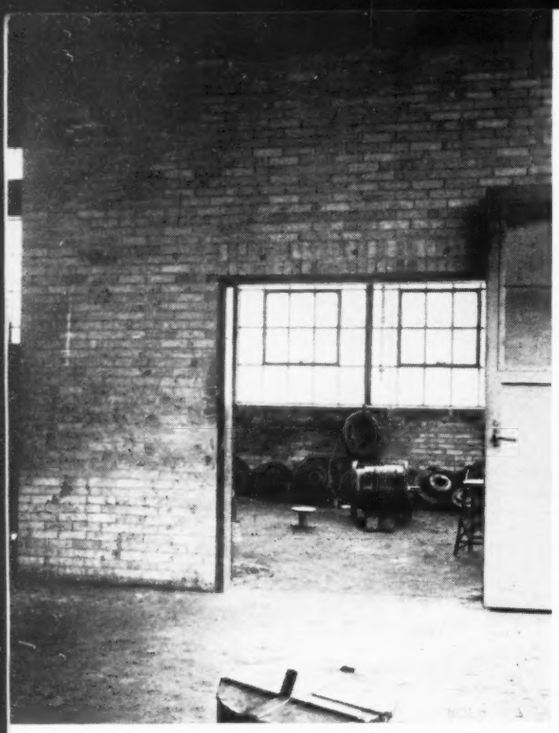
This underground shop, several miles from the portal, includes machine tools which serve the whole plant.

Principal requirements of these underground shops are: (1) plenty of space and concrete floors which can be kept clean and free of grease, (2) convenient pits and cranes and (3) separate but adjoining rooms for lubricants and repair parts and for the work benches where jobs on small parts are done. Seldom is a separate welding shop justified underground. The main room should be equipped with at least one arcwelding machine and a gas-welding and cutting outfit in addition to portable units which are subject to call to the working sections.

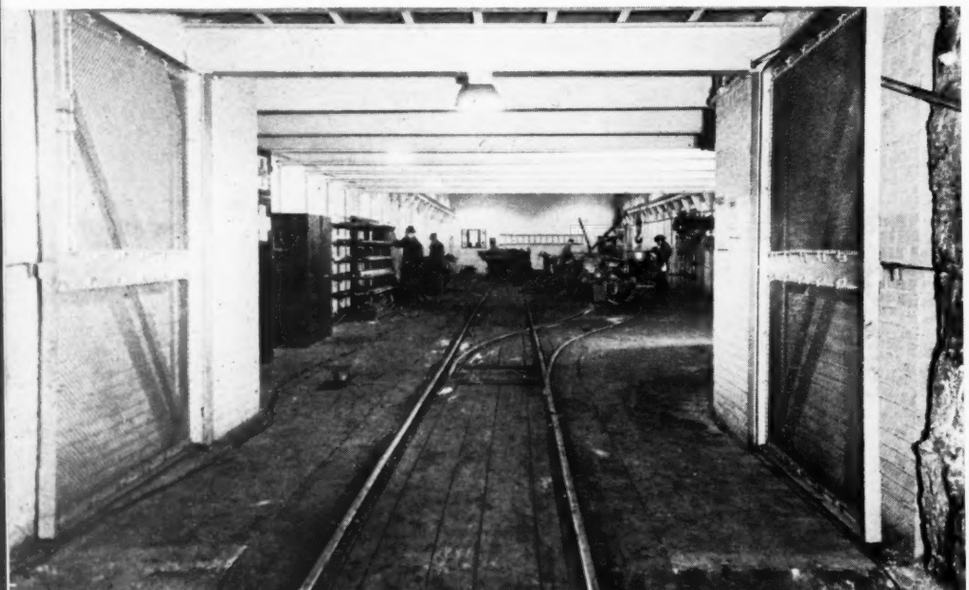
Considering the case of a large isolated mine needing machine-tool facilities, there arises the question of where the shop should be; on the surface and perhaps near the preparation plant, or underground and in



Curtained booth in separate welding building in a central shop, with exhaust system.



Looking into dustproof and blower ventilated cleaning room in a central shop.



Main room in a modern underground shop without machine tools but with all other facilities for running repairs and installing assemblies from a central shop.

Radial drill for car bottoms assembled from post drill and spare motor.

connection with the shop handling running repairs. Above ground is preferred except where there is little equipment on the outside and lots inside and the shaft is deep or the center of working several miles from the shaft or portal. In that case the whole maintenance job can be concentrated at one point with advantages from the standpoints of transportation and supervision.

In all but a few special cases, mine-car shops, however, should be on the outside where space is cheap and where, at most mines, the cars move in their normal travel. Safe and convenient crane or hoist facilities for turning cars on their sides or upside down is the most important requirement of the shop. With steel cars, facilities for bending and twisting them back into shape come next. Simple means, such as heavy hooks securely anchored in the floor for holding down certain parts of the car when straightening it by crane or lifting jack, can be a great help. Arcwelding and torch outfits, of course, are a necessity. Replacing planks in bottom or sides of wooden cars calls for special drilling equipment and power wrenches. Templates should be prepared for all standard drilling, for which the shop should have a radial machine. Compared to a portable drill, the radial unit reduces manual labor, drills holes plumb and is safer to handle. A radial mounting for a portable drill can be built at low cost from scrap materials available at the mine. Even a blacksmith-type post drill can be used in assembling a radial outfit (*Coal Age*, October, 1941, p. 134).

Coordinating Supervision

Shop management, of necessity, was but briefly touched upon in the article on maintenance organization and personnel (p. 67). Where there is a central shop set-up, the foreman or superintendent of this shop should report to a man who also heads the operating maintenance of the mines. Otherwise there is difficulty in coordinating work so that all parties concerned strive to do everything possible to reduce equipment delays and overall maintenance costs.

When the maintenance man at the mine believes the man in the central shop is not doing the best possible job he loses heart. Contrariwise, if the shop man feels that the men in the mines are not installing the parts properly or are slighting inspection and day-to-day maintenance he also may lose the urge to do the very best shop job at the lowest possible cost. It takes one man with a knowledge of all phases to bring about harmony and efficiency.

At individual mines there is less question over division of authority. There naturally is the chief electrician and/or master mechanic who supervises the shop. Depending on the size of the establishment, he may have a shop foreman or simply a head man in each department. Because of the simplicity and standardization of car-shop work it is quite practicable to relieve the chief maintenance man of direct supervision over that branch and put this work under the outside foreman.

MAINTENANCE SUPPLIES

Quick Delivery of Parts and Materials Vital—Orderly Storage Promotes Efficiency—Perpetual Inventory Helps Where the Number of Items in Stock Is Large—Systematic Delivery Should Guard Against Wrong Routing

PREVENTING trouble, as far as possible, should be the goal in maintenance work, but even preventing wear by lubrication, as an example, requires a steady supply of a material. With all the recent improvements in equipment and methods, an astonishing total of materials is broken, worn or lost, not counting mine timbers, ties, rails and other bulky construction items. Effective maintenance, among other things, also requires quick delivery of new or reconditioned parts to the point of application.

Quick Delivery Essential

The quickest delivery of all, perhaps, is when the repairman in the working section finds a fuse blown and reaches into his tool bag for an extra. Obviously, however, the tool bag will hold only a few recurrent items. Next best is a parts stock in the repairman's shanty or headquarters in the section, next a stock in an underground supply room, next a stock in a supply room on the surface and, finally, a stock in a central supply house serving several mines or at a mill supply house or equipment manufacturer's district supply house in the vicinity. The extreme is the time-consuming method of having to order a part or material from a distant factory. Obviously the degree of preparedness must strike a balance between frequency and probability of need, cost of the items and cost of delays through failure to have items on hand.

Consider first the problem of servicing renewal parts to underground production machinery such as drills, cutters, loaders, locomotives and conveyors. Keeping frequently used small parts in the section is a necessity if delays are to be held down commensurate with the investment and production labor involved. Only by a careful study of past requirements and the exercise of practical judgment based on knowledge can the number of parts to be kept in the section be determined. The same goes for the volume to be kept in the main underground wareroom, the supply house on the surface or the central supply base.

One thing is certain: Be it a large stock or small, proper space and bins should be provided to keep the parts where they can be readily found and identified and where they are free from conditions which would result in deterioration and are reasonably safe from theft or misappropriation. A vertical board with hooks like those commonly used for tools serves very well for the few parts kept in the section, such as hoses for loaders and cutters with hydraulic controls. Certain other small parts and supplies, like friction tape, can be kept in a locker provided for the maintenance man beside the supply board.

From the standpoints of space and fireproofness, steel bins, of course, are preferable to wood in supply rooms and supply houses, and the rotating circular bin with tiers of small pockets is a convenient means for storing many small parts, including screws, pins, bolts, nuts and washers. For the duration, obviously, there will be few cases of tearing out wood bins and installing steel but wood still is plentiful and at many mines construction of additional wood bins would pay dividends in supply and maintenance work.

Clerk May Save Cost

When the number of items stocked at a mine runs into the hundreds the need for a stock clerk and perpetual inventory is apparent. Careful analysis of losses, time taken by mechanics to find certain items and production delays because of failure to reorder parts or supplies in time will show that a supply clerk will more than save his keep at a relatively small mine. It often is possible, however, to postpone hiring a clerk by making the chief electrician responsible for repair parts and mechanical and electrical supplies. Being familiar with all items, he can glance along the bins and detect those in short supply.

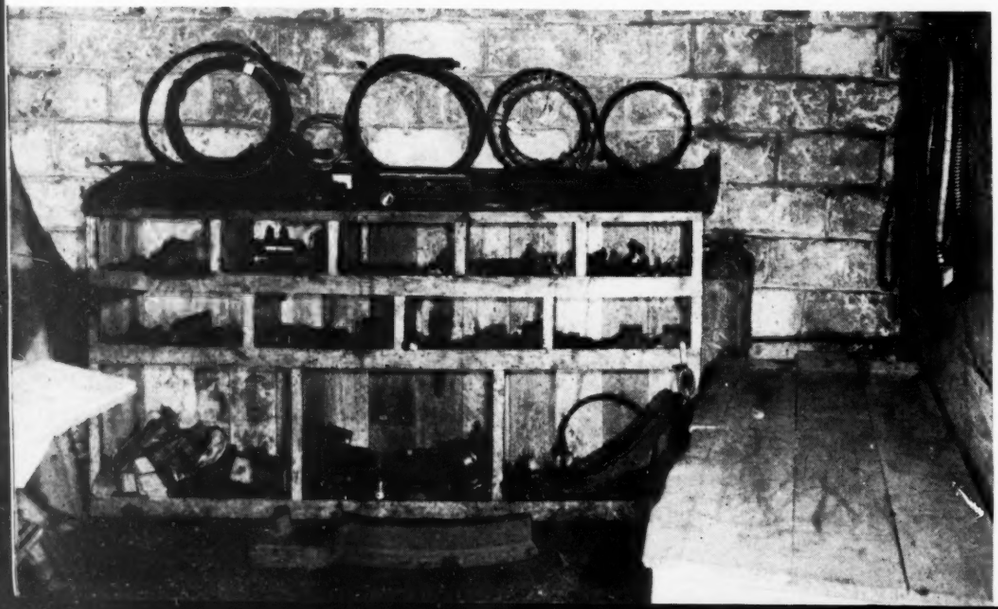
Perpetual inventories for central supply houses or for individual mine supply rooms are kept successfully on loose cards of about 5x7 in. in size or on a larger size filed in drawers,

Stepped-back bins, a number of windows and skylights and artificial lighting units on brackets between the bins encourage quick operation and orderly housekeeping.

Outside warehouse with steel bins with eight rotating units in background.

Supply room adjoining repair shops on the shaft bottom at a big mine.

A few loader and machine parts are kept handy in this section boss' shanty.



but at the larger properties where the items run to 4,000 or 5,000 the commercial-type visible-record binders are great labor savers. Bins for all parts of a certain type of machine should be grouped together and the individual bin number should appear prominently on the inventory record card.

Sufficient space and good illumination are primary requisites for the cleanliness, orderliness and accuracy necessary in the warehouse. Lubricants require special facilities, and these are outlined in the article on lubrication (p. 75).

Transportation of supplies from central warehouse to mine warehouse and from mine warehouse to underground shop or working section is another activity which must be systematized, avoiding over-frequent trips, errors and confusion. There are bound to be emergencies requiring special trips at inconvenient hours, but it has been demonstrated many times that most of the "emergency" demands for material can be systematized out of that class and into the regular delivery class. Daily reports by all concerned showing materials needed for the next day or shift are the basis for licking this problem.

Tags Prevent Misrouting

Sending materials to the wrong place or section of the mine is inexcusable. Oral instructions can be issued but the surer way is a tag carrying the destination in large lettering. That pins responsibility. At the material-loading station on a main haulway where tagged items are left for distribution during the shift, movable signs or electric switch-on signs showing that material is waiting to go to so-and-so section indicate which motorman should stop for the pick-up.

Manufacturers' district repair-part warehouses and the commercial mine supply houses are a great help to the coal industry and those in charge of maintenance and responsible for securing and delivering supply items and repair parts should know what these houses usually keep in stock. A good mine supply house within 5 to 20 miles, plus a manufacturer's branch within a day's distance, can relieve a fair-sized mine of keeping a stock so large a clerk is necessary to supervise it. The extent to which this manufacturer's branch and commercial supply house service can be utilized depends, of course, upon the degree of standardization of equipment in the mine, which in turn is often limited by natural conditions.

Fireproof oil house with mono-rail chain block through door and spillage trench in front of barrel shelf draining to sump.

LUBRICATION METHODS

Lubricant Cost Less Vital Than Proper Methods—Prevention of Contamination a Primary Objective—Types of Lubricants and Methods of Lubricating Different Equipment—Proper Methods Result in Major Savings

WHEN solid surfaces slide over or rub against each other, the result is wear and friction manifested by heat. These effects, however, are reduced to practically zero if a liquid free of solid particles is kept between the surfaces. Oil is the most suitable liquid because it prevents corrosion, does not mix readily with water and can be made with a wide range of fluidities to suit conditions. The problem is to keep it between the surfaces. Upon degree of lubrication depends the severity of the maintenance problem for fully three-fourths of all items of mining equipment. At this time, therefore, when our existence depends largely on our ability to manufacture or conserve machinery, lubrication deserves the closest scrutiny.

To lubricate properly and without the slightest interruption takes precedence over cost of the lubricant, and even over wastage, on most items of mining equipment. An exception is a cutter chain, where wear on the outside of blocks, guides and head is less expensive than would be any known method of keeping these surfaces lubricated. Bearings in modern equipment present few difficulties because they are sealed to retain the lubricant and keep out the dirt. It is with the older types of bearings and items like wire rope and open gears that consistency of the lubricant and its action under temperature changes are highly important.

While oil, as stated, is the ideal lubricant for practically every purpose, in many duties, such as an open gearing, guides and slow-speed shafts where the pressure is high, it is difficult to keep it where it belongs. A gear reducer can be inclosed and therefore it is relatively easy to seal the whole unit. Hence oil, which lends itself readily to splash distribution, is used. But a ball bearing on a locomotive motor would be very difficult to seal; so grease is used.

Oils are combined with soaps and fillers to make grease. The object is not to improve the lubricating quality of the oil but to form a semi-solid or solid substance to keep the oil where it belongs. The soap is the product of a reaction between a fatty substance and an alkali. A tallow base is used in some lubricants, such as steam cylinder oil; sodium soap in certain light fluid greases; and calcium soap in many of the heavy greases.

Between 10 and 20 grades of lubricating oils and greases should meet all requirements at a fully mechanical mine and in a check-up of lubrication practices the first job is to determine the minimum number of grades to do the job. This is done by studying the recommendations of equipment manufacturers, plus those of oil and grease companies, and by applying knowledge gained by operating experience.

Storing and handling lubricants so there is no contamination cannot be overemphasized. This means an absolute ban on containers standing open and, in case of greases, great care when transferring by hand. An example of what not to do is dropping the grease paddle on the gritty floor, then picking it up and continuing to dip without thorough clean-

ing. Any program to improve lubrication should start with storage and handling to prevent contamination, with cutting loss a second objective.

Handling facilities must be convenient to get men to use care in storage, dispensing, transporting and applying. Lifting facilities should be provided for heavy containers. In the oil house on the surface or the oil room underground, concrete floors, which can be kept clean, are necessary. Barrel pumps, drip pans and good light are prime objectives.

There should be no divided responsibility in handling, and that requires individual containers for each man that does lubricating. Some years ago, when oiling the old-style short-wall cutters was the principal underground bituminous lubricating problem, numerous mines were equipped with oil houses having individual locked compartments for the oil cans of each crew. This put a stop to some difficulties for which the individual was not responsible and left no excuse for failures where he was responsible.

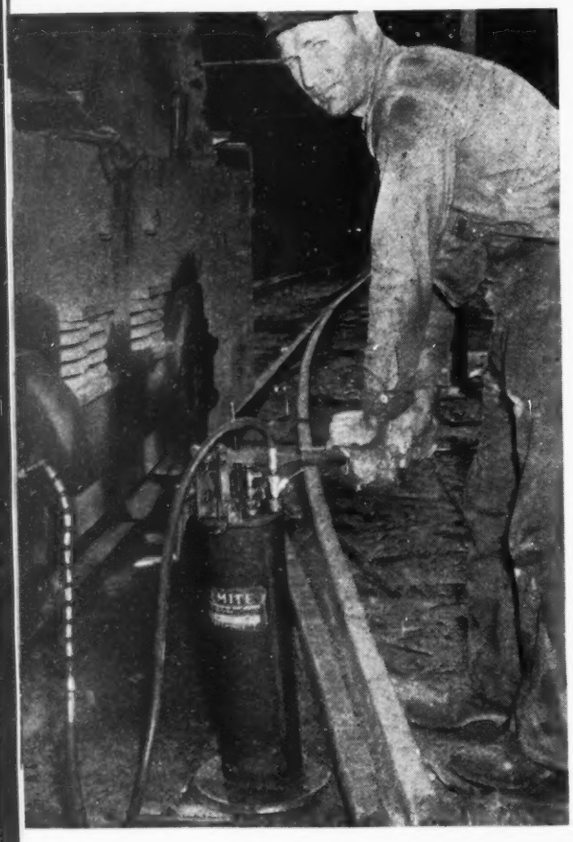
While bearings of the rolling or anti-friction type require very little lubrication as far as reducing friction is concerned, their lubrication is important because of the high cost of renewals and present difficulties in obtaining new bearings, as well as loss of operating time. The function of the lubricant is more to preserve the smooth surfaces of the balls and rollers by keeping out water and dirt than to separate wearing surfaces. Theoretically the only sliding friction surfaces are between the cages and the rollers or balls.

In general the lubricant for ball and roller bearings should be a light grease of a vaseline-like consistency or slightly stiffer. It should have a wide range of working temperatures (approximately minus 25 deg. to 250 deg. F.) and should not contain over 0.01 percent free sulphur. Special grades may be required for unusual duties.

Methods of cleaning the bearings and applying the grease are highly important. For illustrative purposes, consider the duty of a ball bearing on an electric motor. Initially, if properly installed, the bearing should be only one-half to one-third full of grease. A bearing with all the space between balls and around retainers packed tightly with grease heats because of the work done in moving the grease. Also, it is unduly stiff when cold.

Pumping renewal grease into a bearing housing without relief or indicator hole is guess work. Therefore it is important that such a hole be provided and that it be as large as possible—say 1 in. instead of ¼ in. Building up excessive pressure in a bearing without a relief hole will overfill it unless air pockets prevent, will force grease through the seals and into places not wanted and, furthermore, may damage the seals.

Many bearings have been ruined by improper treatment during cleaning. The damage is done by rust after the bearing has been cleaned with gasoline. It should be dipped in high-grade oil to coat all the surfaces before it is regreased, as the grease is slow in getting to all points on the polished surfaces, and if the bearing is not put into service immediately those gasoline-cleaned and unoiled surfaces will rust. The proper way is to wash the bearing in kerosene, let it drain thoroughly or blow it out with dry air, then dip it in light oil. Finally, after most of the oil has drained off, pack the bearing one-third to one-half full of grease.



Left, a measured quantity of grease is added to roller bearings on locomotive.

Below, greasing conveyor-belt idlers.

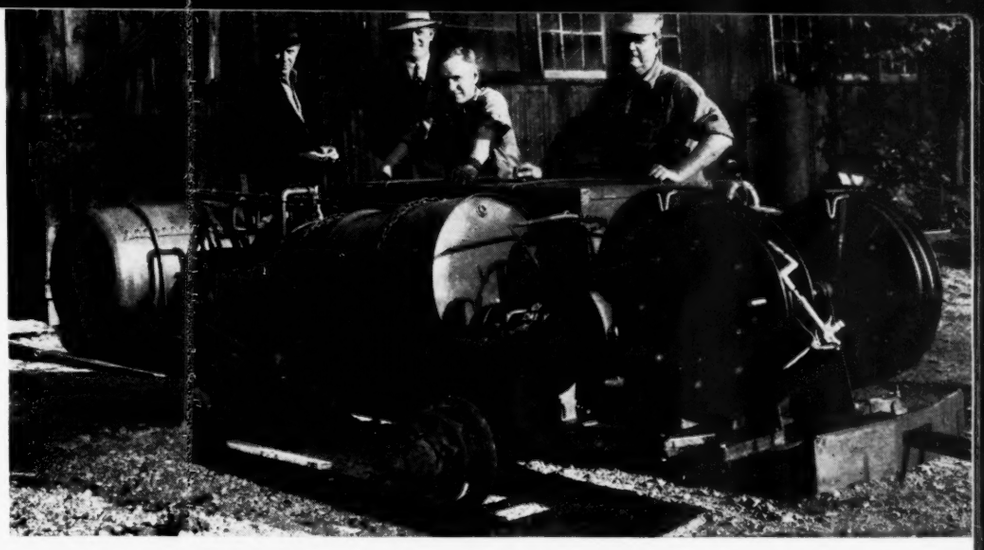
Flush Bearings Correctly

Bearings with drain plugs in the bottom of the housing can be flushed without dismantling. With plugs out, motor running and holes reamed free of caked grease, a solvent, such as carbon tetrachloride or one of the commercial preparations, is poured slowly into the pressure hole, continuing until it does not seem to be dissolving any more grease as indicated by its coming out fairly clear. Next the drain hole is closed and the bearing allowed to run 2 to 5 minutes full of the solvent. Drain the bearing and continue flushing with solvent until the drains come clear. Clear out the remaining solvent by a running flush-out with light oil. After draining, and with the drain hole still open and the motor running, add new grease until it comes out the drain. Do not replace the drain plug until after several minutes of running, during which time excess grease will drain out.

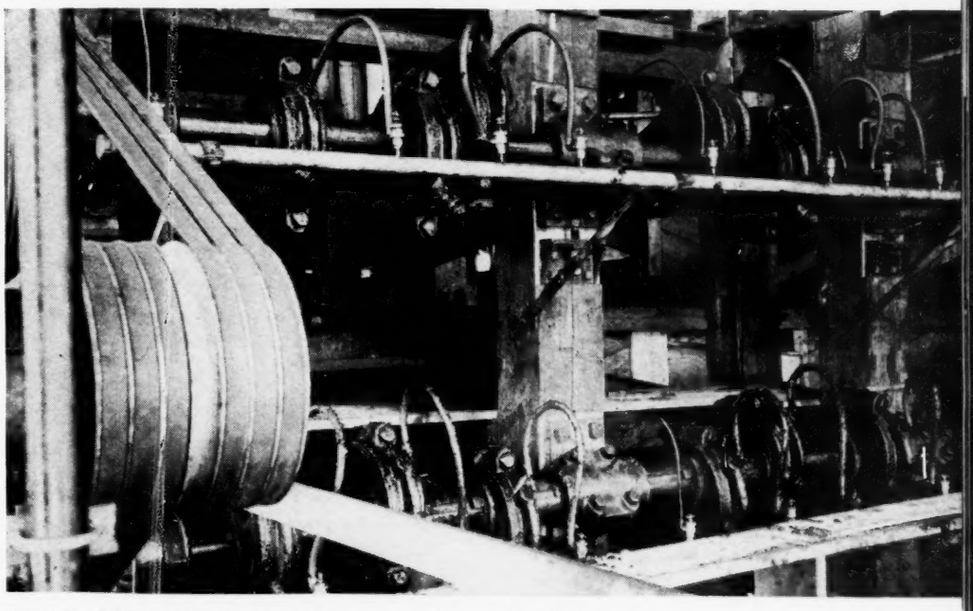
Sleeve bearings must be designed so the lubricant can get between the surfaces. If shaft and sleeve are highly polished, the clearance is limited and no grooves are provided, and the speed is moderately fast with a high unit pressure, the bearing may fail quickly

even though oil is fed to an open point at the top. This is not to say that surfaces should not be polished. The smoother the better, assuming that grooves are provided to distribute the oil the length of the bearing and well down the sides toward the bottom. When unusual difficulty is experienced in lubricating a certain bearing, a study to locate and remedy faults or design of loading should be made before searching for some new special grade of lubricant.

With ring oiled bearings, auxiliary reservoirs should be added unless the well capacity is quite large. The object is to reduce the labor cost of lubrication and provide a greater factor of safety between inspections.



Pressure-operated greasing truck for underground mining equipment.



Centralized lubrication to eccentrics in an anthracite breaker.

Filtering Restores Most Oils

Filtering can restore most oils to practically new conditions, as indicated by the fact that power-house turbines with filters in the circulating system have been operated at high speeds 24 hours per day for periods of ten years or more without changing to new oil. Internal-combustion engines equipped with crankcase filters and with the filter elements renewed often enough to keep the oil clear have been operated indefinitely by merely adding oil instead of draining and refilling; this without signs of abnormal wear.

Groups of sleeve and eccentric bearings in a preparation plant are lubricated efficiently and at low cost by greasing through pipes from a central pressure lubricator. An alternative system, and one making it easy to control quantity of grease to each bearing, is to bring the grease pipes out to a safe place and group a number of them, with their pressure-gun fittings, at one point. Systematic procedure in inspection and lubrication and trustworthy men are equal in importance with bearings of proper design and the best possible provisions to shield them from dirt.

Lubrication of wire rope is a specialty treated under the general subject of wire-rope maintenance (p. 110).

With underground mobile machinery the major question of whether operators, repairmen or special lubricating crews shall do the greasing depends on the size of mine and type of equipment and is discussed under loader maintenance (p. 87). The same rules of cleanliness, regular attention and of judgment in not overgreasing apply.

In greasing anti-friction bearings on mine cars, greasing wholesale on an off-day, in contrast to greasing piecemeal during operation, generally is advantageous from the standpoints of elimination of interference with production and greater surety of getting every car. Greasing stations with power guns and hose connections on both sides of the tracks are practically indispensable in either case. The quantity to each bearing should not exceed a standard indicated by a volume meter at the end of the hose.

Considering again conditions affecting lubrication in general, pitting due to electric current is one not often encountered but to be suspected when without apparent mechanical reasons a certain bearing or group of bearings wear out or go to pieces much sooner than is normal. Stray currents affecting bearings have been found on many types of electrical machines and in bearings of related equipment. The trouble may be a grounded coil in the machine, a ground in a resistor, electrical unbalance through an open circuit or an inherent fault in design. Remedies include removing grounds, insulating machine pedestals and adding ground-current collector brushes to journal shafts.

Grease- and oil-saving campaigns, many stimulated by oil company representatives, usually result in marked savings in quantity of lubricant used, principally by reducing wastage from leakage, overfilling and improper handling. Cost of all lubricants per ton of production should be scanned once a month if the accounting system permits that close a check. Semi-annual and annual checks usually give a truer picture. At very few fully electrified mines should the cost of lubricants average as much as a tenth of the cost of power figured at 1.5c. per kilowatt-hour.

ELECTRICAL CONDUCTORS

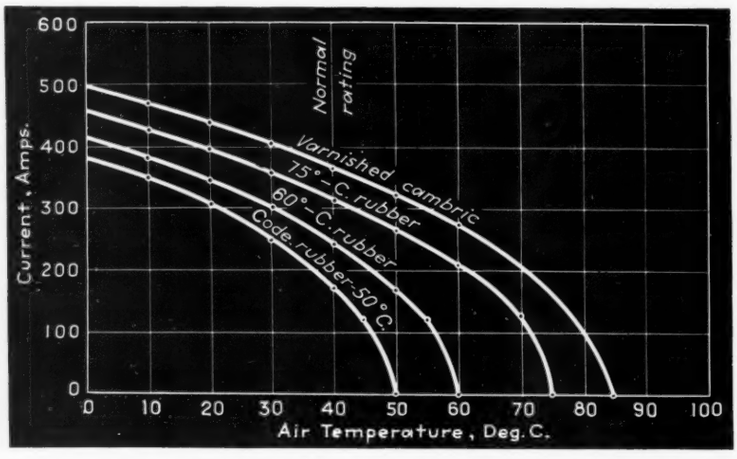
Conservation Now Ranks With Service Interruptions—Short Transmission Lines More Important—Good Splicing Conserves Cable — Vulcanizing Desirable — Lower Cost in Good Overhead — Full Track Conductivity Vital

ELIMINATION of power interruptions and resulting production delays originally was the major objective in improving the maintenance of wires and cables. Now, difficulties in obtaining new copper conductors, especially those insulated with rubber, have made conservation an equally important incentive. Substitute materials for insulations and jackets bring new problems in care and operation. More efficient use of rails as conductors and shorter distances for lower-voltage transmission assume greater importance.

Pole-line transmission of a.c. on the outside presents but limited opportunity for maintenance improvements because conductors are bare, their mountings are simple and they are relatively free of mechanical wear and injury. Extending the high voltage—that is, keeping the transformer substation as close to the load as possible—is the principal thing to watch. Two or more transformer substations instead of one to supply 220- or 440-volt power for a group of surface buildings may release considerable heavy copper.

At large preparation plants where the electric load is heavy the transformers should be close to the building and near the center rather than out from one end. Or, if fire-protective measures are feasible, they should be in the center of the building itself. There should be no hesitation in using open wiring to save steel conduit in locations where danger of mechanical injury is slight and where explosive dust does not accumulate near the wires. Open wiring properly installed in protected places in buildings is likely to be more free of maintenance than a rigid conduit job and presents an opportunity for low-cost changes in wiring. To reduce impedance, the individual conductors of an a.c. circuit should be kept close together. Porcelain insulators of the round three-hole type are available.

At old plants that have undergone numerous changes the pole lines and the wiring in buildings should be checked and the unused circuits dismantled and recovered. To recover the scrap should be incentive enough, but often a lot of the wire and conduit can be used again.



Current-carrying capacities of 4/0 single-conductor cables in air. The new jackets of lower-percentage rubber will stand less heat. Closer attention to circuits and unwinding cables from reels, where possible, will be necessary.

With half a chance, a.c. and d.c. cables suspended in boreholes and shafts give long service without attention, but there is danger of neglecting inspection that might reveal an impending breakdown. At the bottom of a borehole, for example, movement due to heating and cooling may wear the cable insulation through where it touches the edge of the casing. Lead sheated and/or armored cables are very liable to damage from stray currents unless bonded to parallel structures. As an illustration, a wire-armored cable in a steel-cased borehole should have the armor bonded to the casing at both the top and bottom of the hole.

Late-Type Arresters Pay

Although lightning arresters on transmission and distribution lines are principally for protection of motors and transformers, many are installed on poles instead of buildings and so are an item in line maintenance. Old-type arresters can handle minor surges but it takes the greatly improved recent types to cope with direct hits, provided they are not too severe. It follows that all arresters should be of the latest type. Adequate grounds are an absolute necessity. Grounding or preparing grounds under all conditions is a specialty on which arrester manufacturers will gladly furnish all the information that may be necessary for doing the best possible job.

Underground, where little remains stationary for long and cables suffer accordingly, the maintenance of electrical conductors takes on added proportions and importance. Trailing cables normally offer a number of problems to which, at present, must be added those growing out of the use of lower-percentage rubber compounds for insulation (less tough and less heat-resistant), plus the substitution of woven cotton braids for rubber jackets.

Rubber has a number of enemies and even sunlight, one of its most aggressive, gets a chance at trailing cables on some of the equipment at deep mines with drift openings. Heat is a foe too often not fully respected. Rubber compounds have critical temperatures above which the normal properties are destroyed in jig time. Maximum safe copper temperature for

code compound with as little as 20 percent rubber is 50 deg. C. (122 F.); for the next better grade, 30 percent rubber, it is 60 deg. C. (140 F.).

Coiled several turns deep on the reel of a gathering locomotive or other mobile machine, a cable has little chance to cool and its capacity to carry current is cut to about one-fourth normal. It is not convenient to unreel the extra cable of a mining machine out on the mine bottom but where the duty is heavy that is the alternative to ruining the rubber. Larger cable is a good alternative but lack of space and design of the reel impose definite limits if long cables must be used.

Mechanical damage rather than plain wear, however, is the starting point for fully 90 percent of the trailing-cable losses. One difficulty is that the trouble is not likely to show up immediately. A cable that has been run over, kinked, pulled tightly around a sharp corner or hit by a falling rock or some supply part being unloaded from a car may not show damage on the outside but it immediately begins to deteriorate in service and finally blows up or grounds at that point.

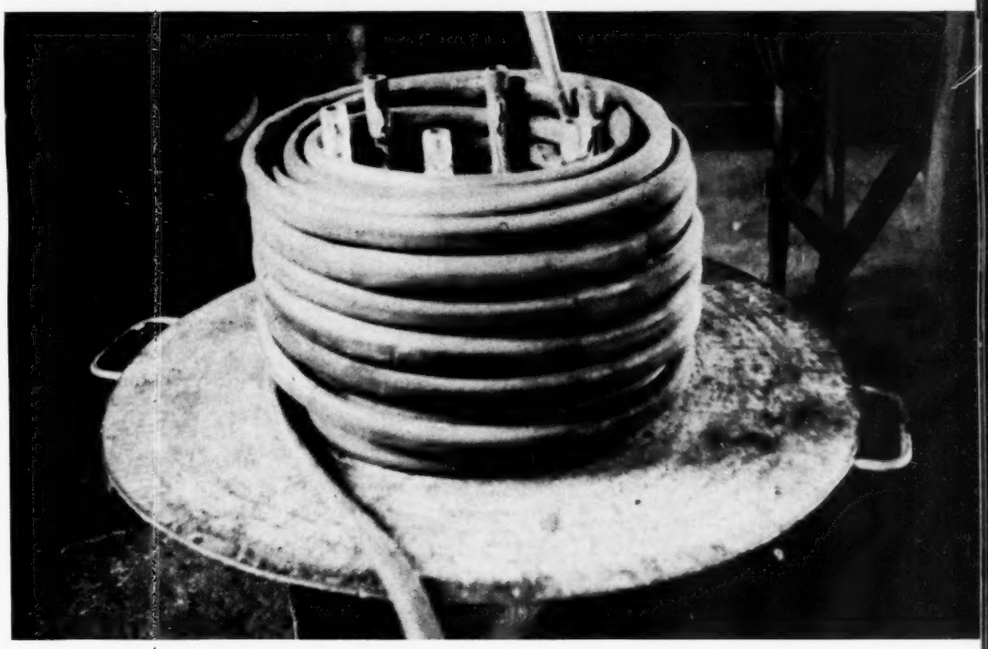
Hooks and Fuses Help

Hooks for hanging and stretching portable cables securely over tracks or other roads used by equipment, plus close supervision to see that they are properly used, will stop damage from one of the common causes. Fused nips will save many cables from severe damage or almost total destruction in case of a short or ground. Cable guides with large free-running rollers or spool-type guides with long radius flares, all kept in good shape, are prime requisites for cable health. With the necessity for replacing rubber cables with new ones with a fibrous-braided finish, abrasion becomes a more serious factor.

Better splices can save large quantities of trailing cable. Since it is difficult to make a temporary or running splice which will not prove a repeater, re-doing these splices and vulcanizing are imperative for efficiency and the conservation now necessary. Whether a cable will be removed and vulcanized after the first splice has operated two weeks or whether the rule shall be removal after four or five temporary splices have been made depends on local circumstances.

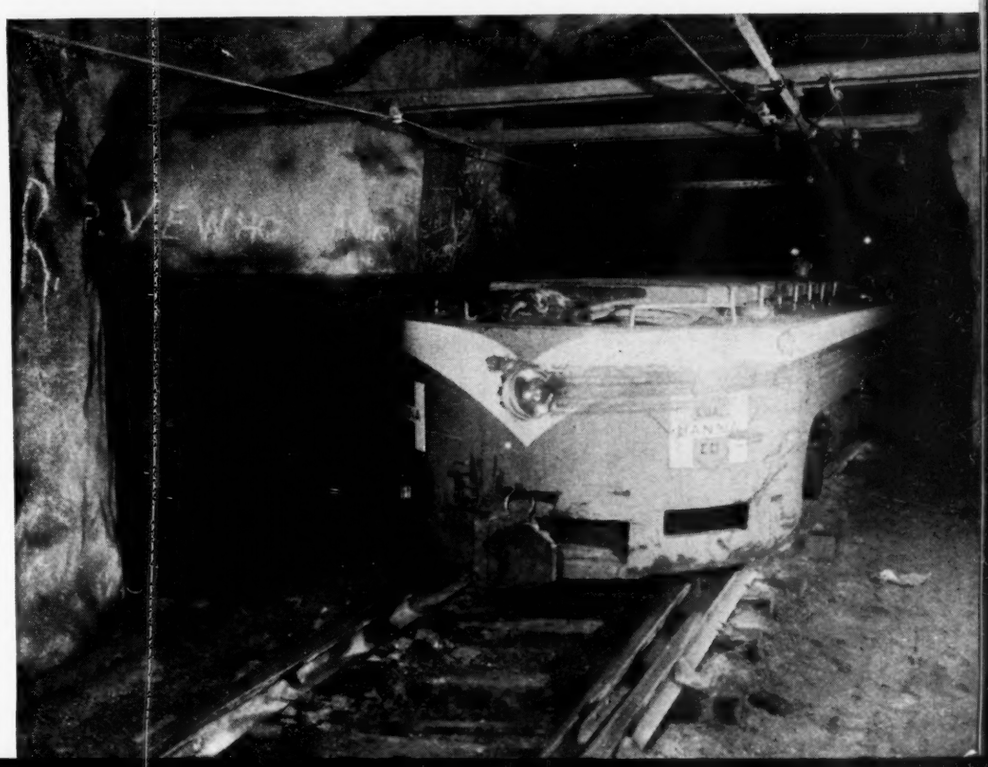
Temporary splices, as a rule, must be made in a hurry and without such tools as a soldering torch, usually by machine operators. Conductor ends should be fanned and meshed into each other, splicers used and the closing done carefully by repeated light taps with a hammer. Strand ends should not extend more than $\frac{1}{8}$ to $\frac{1}{4}$ in. beyond the sleeve and before tape is applied all ends should be laid flat so they will not cut through the tape. This final operation of putting on the tape can also be done in a right or wrong way. It should be pulled tight, lapped uniformly (about $\frac{1}{2}$ lap) and the ends of the bulge carefully tapered.

Permanent splicing in rebuilding cables in the shop can be done with a non-soldered split sleeve like that used in the mine or by a butt joint soldered in a shorter and lighter sleeve. The latter takes little more time but makes a joint smaller in diameter. Rubber tape applied to the right thickness and then vulcanized makes a joint that will stand service almost like a new cable. A few years



Loading-machine cable assembled by splicing and vulcanizing short lengths.

Welded 60-lb. track, 1,000,000-cir.mil feeder, a tight nominal 6/0 trolley wire and gunite overhead spell copper conservation and low d.c. maintenance.



Special bench and vulcanizer in a d.c. substation. One man does the splicing and vulcanizing and looks after the station units.

ago not many companies would use pieces less than 10 ft. long in rebuilding cables. Now, with underground trailing cables costing up to 60c. per foot and hard to get, pieces only 3 to 4 ft. long are worth vulcanizing into a cable. To get lasting qualities in conductor insulation and sheath it is vitally important to avoid overheating the rubber during vulcanizing.

Splicing of stationary cables carrying 2,300 volts or more is a specialty requiring knowledge and experience and presents a wide variety of problems because of variations in cable design. As in trailing cables, the best job of splicing individual conductors is a butt joint soldered into a sleeve which need not be over ¾ to 1 in. long. Penciling the ends of the insulation for a distance of ½ to ¾ in. before wrapping with tape becomes increasingly important with higher voltage.

Underground a.c. distribution cables carrying 2,300 volts or higher should now, more than ever, be protected against mechanical injury by closer posting and roof inspection where hung on rib or top. If placed on the bottom, they should be installed in trenches or covered with sand or fine material topped with a few inches of coarser slate or rock. Overload oil circuit breakers should be installed to protect all branches. Long runs also should be sectionalized with breakers every 1,000 to 3,000 ft.

Stranded cables in 500,000- to 1,000,000-cir.mil sizes used as low-voltage d.c. and a.c. feeders in the sections and moved often, present a strand-fraying problem if bare. Making up the cables in shorter sections with terminals attached for joining with bolts simplifies moving and is likely to be less damaging to the strands. A weatherproof covering affords strand protection as well as giving some protection against shock. If dragging is insisted upon when moving, permanent terminals are practically ruled out because of catching.

Wear of trolley wires usually is not so rapid as to be thought of as a maintenance item but maintaining the overhead system in proper condition is highly important from the standpoints of safety, loss of operating time and wear and tear on the wire, frogs and runners. Keeping the wire tight to avoid flexing and hammering at the supports is of first importance. Strong dead-ends with turnbuckles and closely spaced hangers on curves are necessary. Before a tightening job, all hangers should be loosened slightly so the wire can slip.

The position of a frog with respect to the track switch is another item affecting wear and operation. When the collector on the end of the pole is passing over the center of the frog, the alignment of the pole should coincide with the alignment of the turnout leg of the frog.

Shoes Save Expense

Runners or shoes instead of trolley wheels as collectors save wire wear and collector expense. When using runners, it was the practice for years to lubricate the wire periodically with oil or grease. Lately, however, graphite is being substituted for oil and at least one manufacturer of line materials supplies a specially mixed lubricant. One coal company reports the use of a mixture of carbon tetrachloride and graphite for burnishing its trolley wires. Steel runners are entirely practical.

The return, or ground, circuit of the d.c. haulage system offers a number of opportunities for conservation of copper. The conducting possibilities of the rails should be used to the maximum, copper returns paralleling the rails should be scrutinized carefully to determine if they are really necessary and short U-bonds should be installed instead of long bonds.

Welded rails afford maximum track conductivity. The difference between welding and adequate bonding, however, is not of high importance. More important is the saving in copper that would be used in the bonds. A 60-lb. welded or bonded track is equivalent to at least 1,250,000 cir.mil of copper, which is greater than the combined areas of a 6/0 (nominal) trolley and a 750,000-cir.mil feeder. An 80-lb. track can be maintained to a conductivity equivalent to 1,660,000 cir.mil of copper, or about the same as a 1,000,000-cir.mil feeder plus two 4/0 trolley wires.

Return Depends on Load

For maximum conductor economy, the two divisions of the circuit, overhead and ground, theoretically should be equally low in resistance. Practically, however, this rule need not be relied on too heavily. If a 60-lb. haulway is equipped with a 6/0 (nominal) trolley wire and a 1,000,000-cir.mil feeder, making the combined overhead conductivity more than that of the track, there is no reason for adding a copper return paralleling the rail unless the load is so high that the voltage drop in the over-all circuit exceeds a practical value of, say, 10 percent at full load.

The point is that if an auxiliary return is installed with connections to the track at close intervals, then rail bonding possibly may be neglected to the point where the track as a whole is being only partly utilized. This and the foregoing paragraphs refer, of course, to permanent or semi-permanent tracks and not to section tracks in concentrated mobile-loading mining where loads are high and track life is short. Use of auxiliary copper returns under those conditions can hardly be questioned.

Installation of automatic sectionalizing breakers on the overhead d.c. system, while principally for reducing production delays and lessening the danger of fire, has a line maintenance value. A fall or accident which brings a trolley wire or feeder in contact with a car, machine, rail or other grounded object can burn the conductor in two and, with the smaller trolley wires and substations with breakers set high or inoperative, can heat the wire to the point where it is softened and made difficult to keep tight from then on. A sectionalizing breaker opens the circuit before heavy damage is done.

D.C. SUBSTATIONS

Good Ventilation a Must—Blowers and Filters Recommended — Auxiliaries Should Be Dust-Tight — Regular Electrical and Mechanical Inspection Necessary, Including Auxiliaries — Protection From Falls Needed

BRUSHES, bearings and breakers are the principal items requiring attention in substations of the converter and motor-generator types. The first is absent in all rectifier substations, and both one and two are absent in the substations consisting of sealed tube rectifiers. The enemies of heat and dust can, in large measure, be controlled by proper housing and installation.

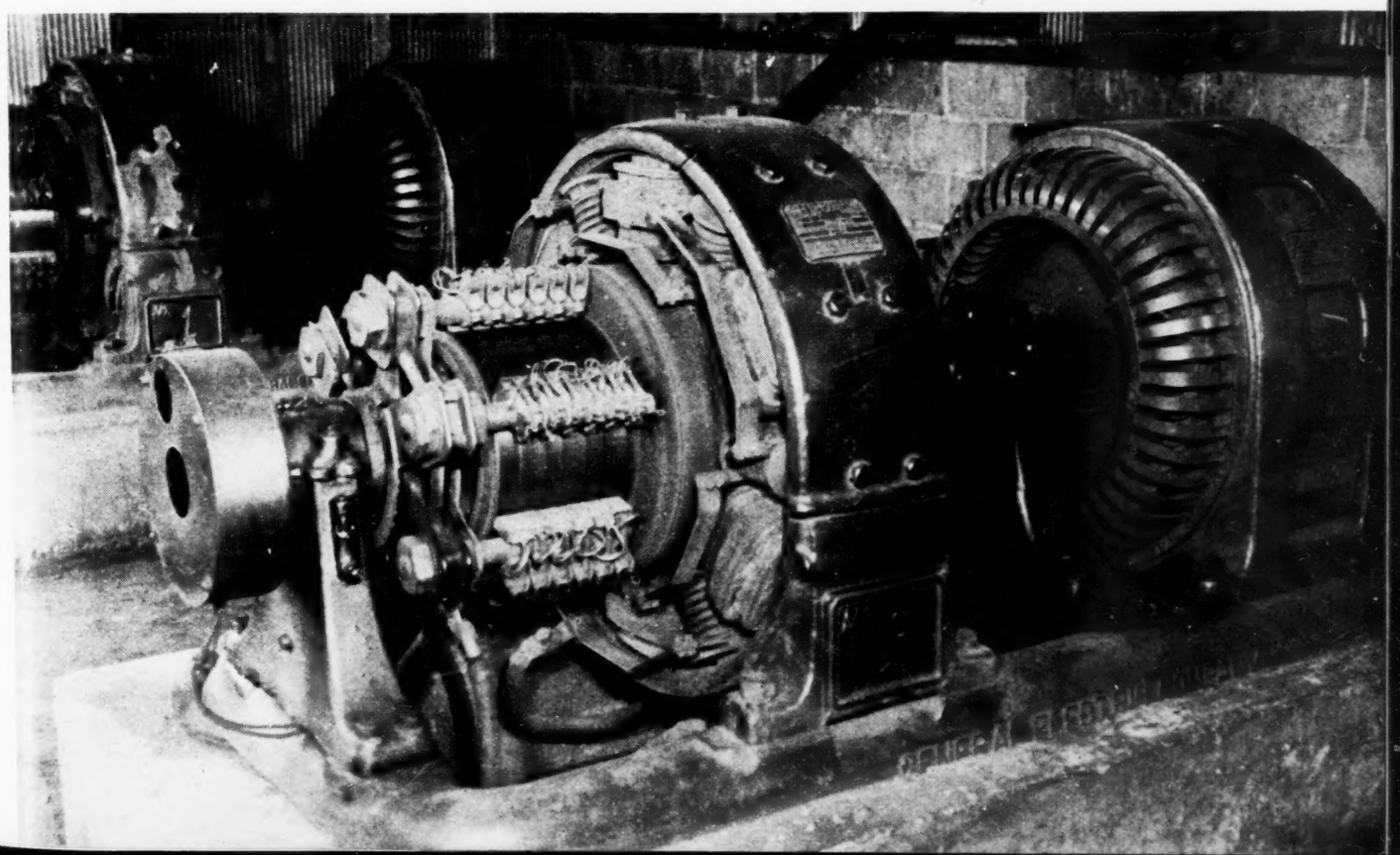
Allowing the windings of a machine to run scorching hot for lack of ventilation is a crime. Buildings above ground housing substations should have large air ducts opening into a pit under the machine and have roof ventilators to help promote the natural circulation. Cross ventilation by large windows (kept open during all but cold weather) may furnish adequate cooling of buildings but also may present problems in barring the windows against intruders and closing them or arranging against entrance of rain or snow during a bad storm. With the pit and roof ventilator system, closed windows promote the natural updraft at the point desired.

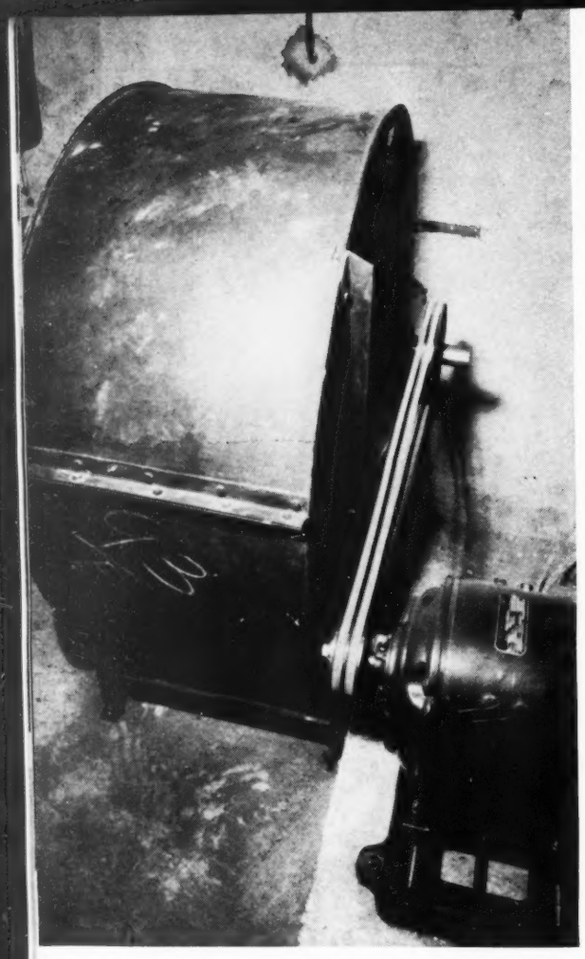
A blower fan driving air against the side or end of a machine in a cross-ventilated room, or in the duct leading to the pit, is a relatively inexpensive means of cooling either the above-ground or underground substation. Thermostatic control can be applied to run the fan only when extra cooling is necessary. In stationary substations underground, this type of cooling can be combined with a filtering system which keeps all mine dust out of the substation. Even so, the room should be located where a current of fresh mine air can be diverted through it by manipulating doors in case the filter-blower system should fail. An air-vane switch in the duct should be connected to stop the substation if that happens.

Keeping dust off the switchboard is almost equally important with preventing accumulations in and on the machines. Every substation should be equipped with a compressor or other source of air at a 20- to 40-lb. pressure. Blowing once a week should suffice for usual conditions. Relays in the open or in cases that are not dust-tight, as well as small contactors, are susceptible to failures through accumulations of dust. Obviously all relay and instrument cases should be made dust-tight if possible and kept closed. This cannot be too strongly emphasized if maximum reliability is to be attained.

Commutator, holders and brushes should be inspected at least once a week. Sparking demands immediate attention, but even in its absence remaining lengths of all brushes should be noted. The brushes should work free in the holders, spring tension should be normal and the shunts tight. A loose shunt may not show up in heating at the poor connection but will cause that brush to carry much lower current, overloading the others. About the same rules apply to slip rings. Correct brushes and maintenance of commutators are discussed in the article on maintenance of motors (p. 105). In an emergency, if load is not too heavy, or in such special cases as using a generator for a number of months at light loads

Brushes and commutators on motor-generators and converters need close attention.





Forced ventilation for a 500-kw. underground substation. An air-vane switch stops the set if the blower stops.

Tops in requiring little attention is a sealed-tube rectifier. A gunite top protects this installation.

and with low-setting breaker protection, there is nothing wrong with operating with many brushes removed.

The transformer bank forming an integral part of a rotary converter unit requires little attention except to check oil level about once a year and perhaps every five years filter the oil or exchange it for new or filtered oil. Purchase of a filtering machine and the necessary tester for dielectric strength is practicable only for the larger companies which have hundreds of transformers to service. Otherwise it is best to buy new oil or hire a power company or commercial repair company to do the work.

Bearing inspections should include a hand check for heat, determination of oil level and observation to see that oil rings turn freely. If the machine is in an outside substation, the latter should include a check during starting after several hours or a weekend shut-down during severely cold weather. That is the time when a ring is most likely to stick. A lighter or better grade oil may be required. All rotary converters and motor-generator sets should have bearing thermostats to forestall severe damage if unusual heating should occur.

With their silver contacts and improved mechanisms, present-day d.c. breakers require only occasional inspection. Many of the older breakers need attention once a week or so.

Oil circuit breakers controlling 2,300- to 6,600-volt power to the units require inspection two to four times a year to see if oil level is right, the oil is in good shape and contacts are operating properly. Oil in a breaker may suffer deterioration much more rapidly than in a transformer, especially if it is a hand-operated breaker and thus can be closed or opened with indecision or hesitancy, with consequent arcing.

Labeling switches and placing framed starting and stopping instructions on the wall or switchboard may be the means of saving equipment from damage if a manual substation is operated by an inexperienced man. Trying to start a rotary converter with the brushes down or closing the d.c. breaker to apply load before the brushes are lowered happens too often. The latter can cause severe damage to commutator, brushes and holders and may even injure the man.

Same Care for Portables

Maintenance of portable substations differs little from that of the stationary. The power unit, if of the rotating type, should be on fairly level track or be leveled by jacks and blocks to prevent armature and/or rotor end thrust against the bearing. Rotating units in all substations should be well balanced because vibration quickly wears the insulation of coils that get a slight bit loose due to heating and shrinkage. The vibration due to unbalance will show up much worse in a portable unit.

Maintenance of mercury-arc substations, all of which are full-automatic, is comparable to that of a synchronous converter substation minus the converters and therefore devoid of main bearing, brush, coil and commutator troubles. The latest sealed-type units with improved ignition are comparable to hermetically sealed household refrigerator units. There is nothing to inspect and they cannot be tinkered with. Internal trouble, if it should come, calls for a replacement unit and a factory repair of the old one.

Adequate protection against falling rock is important with portable substations of both the mercury-arc and rotating machine types. If not placed in a room with structural or gunite roof, then the units of the substation should have sheet-metal canopy tops or covers to prevent damage from small pieces. Also, the roof should be timbered if it shows weakness.

MINING MACHINES

Bar, Chain and Bits Big Items in Maintenance—Sharp Bits Vital—Hard-Surfacing Increases Tons Cut—Regular Lubrication and Inspection Essential—Hydraulic Systems Merit Special Care—Good Brakes Needed

THE BUSINESS end, consisting of the cutter bar, chain and bits, naturally is directly responsible for a large percentage of the maintenance cost of mining machines. Lack of proper maintenance at these points brings grief aplenty to the electrical and mechanical parts of the rest of the unit besides causing breakage of ropes on shortwall cutters. Equally important with maintenance of the business end are good power and operators properly instructed, able and willing. Cutting-machine maintenance cost usually ranges from 5 mills to 3½¢ per ton. If, by more careful operation, a saving of 2 mills could be made, the maintenance saving, if 500,000,000 tons was cut in a year, would aggregate $1,000,000.

Keeping bits sharp and chains in good shape perhaps may precede fussing about bad power. Sharp bits set properly in free-running chains can reduce load so much that working voltage may increase from "terrible" to "fair." Then comes the time for more copper or a closer substation to bring the voltage to "good." With the d.c. substation adjusted to 275, face voltage at normal full load should not drop below 250. With a.c. transformer taps adjusted for 240 volts and the motor rated 220 volts, the face voltage, with average load on the motor, should not be under 215.

While number of positions for a chain (five, seven, nine or eleven) and the type of lacing may be rather important for specific natural conditions or markets, sharp bits and a setting that gives ample kerf clearance (at least 1½ in. wider than the cutter bar) completely overshadows them.

For practically all the duties, however, heat-treated and/or hard-surfaced bits pay handsome dividends. Throwaway-type bits made of high-grade heat-treated steel are a tremendous advance over the standard bit without treatment or surfacing. Some operators have found that it pays to surface the throwaway bit and certain manufacturers of those bits will furnish them plated if so specified.

Tenfold improvement in tons cut per standard bit by plating has been reported by some companies. Fourfold is common. A tungsten-carbide preparation, usually applied by gas torch, gives the hardest plating. This can be so thin and extended back such a short distance from the point (⅛ to ¾ in.) that as many as 3,000 bits can be treated per pound of material. Tipping less than 500 bits per pound of tungsten-carbide is almost a sure indication that it is being applied much thicker than necessary. A deft operator with a proper setup can tip 300 bits per hour. A rotating round table with bits in a groove at the edge has proved the most efficient at most operations.

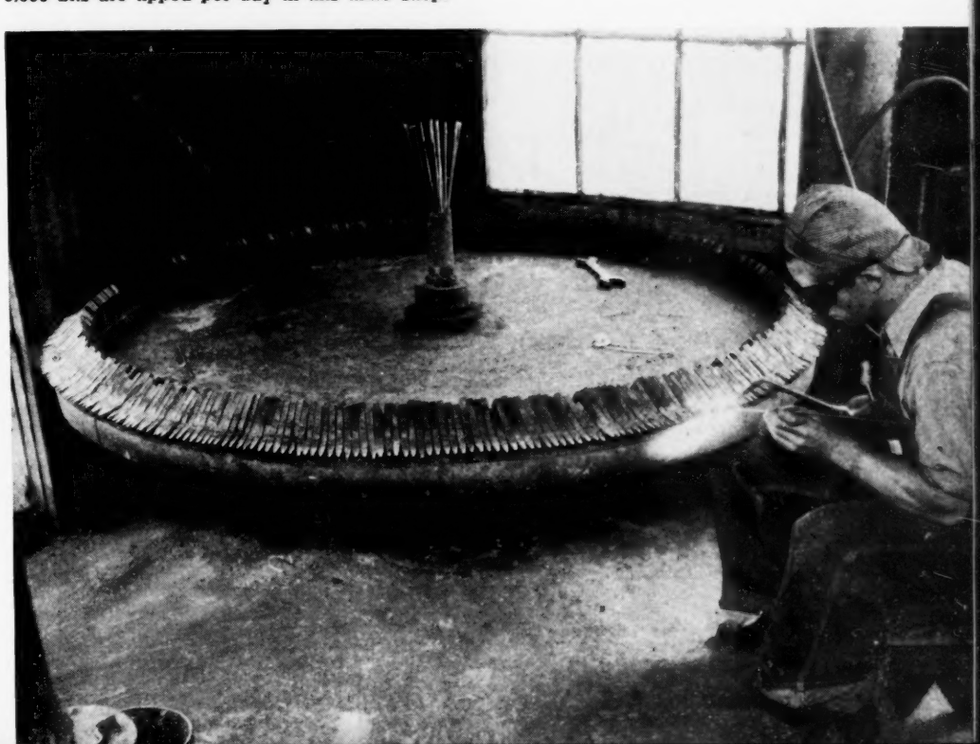
Bit shape always is important. There should be considerable face or point clearance (at least 10 deg.) and some side clearance (at least 5 deg.). Face rake should be at least 20 deg. and bit strength and toughness must be suited to the cutting. For standard bits to be heat-treated, 0.60 to 0.70 carbon steel is suitable. After rolling or hammer-shaping they should be reheated to about 1,300 to 1,400 deg. F., quenched in oil and the temper then drawn at 400 to 500 deg. F.

Adjusting chains so there is no slack and yet so they are not so tight as to bind on the head is a matter of experience. Cutting backward, which is sometimes done with track-type machines, adds to power requirements and increases wear on chain and head. Worn cutter-bar guides allow the chain to be distorted out of line, in turn increasing pivot wear. Keeping cuttings shoveled away from the chain on a bottom cutter reduces the power demand and thus favors the whole machine.

When new chains are applied, the drive sprocket, if worn to any extent, also should be renewed. Otherwise, the pitches do not match and extra strains occur. Patching chains, except in emergencies, is poor practice, as it soon means a mixture of new and old parts and failure of the old every so often. Spare chains and complete rebuilding are the answer.

Chain lubrication always has been unsatisfactory and the increasing use of water on the cutter bar to settle dust has added to the problem. Because a large percentage of the oil applied to the chain appears to be wasted and that which gets where it is needed is contaminated with coal dust and perhaps with abrasive im-

6,000 bits are tipped per day in this mine shop.



purities a low-priced oil usually is preferred. Oiling after each cut and thus giving the oil some time to penetrate before the next cut is the recommended practice.

Problems of motor and control maintenance common to most types of mining equipment are dealt with in other articles (pp. 105 and 108). Once-a-month inspection of the brushes, brush-holders, tension springs and commutator on a mining-machine motor should be sufficient if thoroughness is practiced in making repairs. Asbestos- and glass-insulated coils have reduced motor maintenance in many cases of tough cutting. Motors for a.c. machines have a very small air-gap clearance compared with d.c. Consequently, gaps should be measured often (once a month), and bearing renewals made if there is appreciable change.

Controller fingers with large blisters should be dressed lightly with a file. Applying grease may reduce wear but it should be done sparingly. Badly burned reversing drums means that operators are reversing before motors have had time to stop. Magnetic contactors should not be greased and any dressing of them with a file also should be light.

Mounted machines with hydraulic systems present new problems arising out of oil leaks and such difficulties as clogged filters and foaming oil. The latter can be caused by water or air. A leak in the suction will pull in air and could pull in water if there should be an accumulation in a pocket at the leak. Cleanliness becomes more important on machines with hydraulic systems. Some disastrous fires have occurred in nests of cables and hose when contaminated with oil and coal dust.

Wire ropes on mining machines should be lubricated, but too often it is not done because for a time afterward the rope is messy for the operators to handle. In any general shop inspection or overhaul the ropes should be soaked in heavy black oil and then be wiped before being put back in service.

Checking a permissible controller during the weekly going-over.

A.c. machines must have especially good voltage and their motor bearings must be checked often because the air gaps are small.

Good Brakes Necessary

Safety of both men and machine calls for keeping truck-wheel brakes in good order. Since the brakes are little used most of the time, there is the temptation to neglect them. If a machine is allowed to coast downhill at much higher than its tramming speed with the propelling mechanism engaged it may cause the motor commutator to flash over, inasmuch as the motor is acting as a generator and the voltage may run very high. Furthermore, the armature coils and bands may not stand the centrifugal force.

Procedure in general inspections and complete overhauls varies as widely as the designs of machines and the types of mines in which they operate. The shortwall, being, relatively simple, can be overhauled over a weekend, if necessary, and in a shop with little equipment, while some types of mounted cutters take a week or two at best and need a fully equipped repair shop. In a mine using several mounted machines of the same type, spare-part units, kept overhauled or built up ready for emergency, can be utilized to speed a general overhaul. A complete spare machine, of course, is an excellent investment if the size of the operation warrants.

Steel truck wheels are readily built up by arcwelding. Welding as a maintenance tool is treated starting on p. 113; building up wheel treads, p. 99.

COAL AND ROCK DRILLS

Proper Handling First Requisite With Electric Coal Drills —Lubrication Includes Two Don'ts—Hose Care Important With Air Drills—Sharp Bits, Good Dressing and Correct Lubrication Help in Maintenance Work

RELATIVELY low cost of new spare units has not encouraged the careful operation and efficient maintenance of air and electric coal drills that should be the rule during the present emergency. The outward appearance of percussion-type air drills, plus the rough conditions under which they work, belies the fine workmanship and quality of steel used in their make-up. Electric drills, because they must be light, have motors with delicate high-grade parts and precision gears built for prolonged use at high speeds. At best, certain parts of drills may need renewal perhaps once a year, but it takes proper handling, lubrication and inspection to achieve this reasonably trouble-free operation.

With electric drills the first step toward lower maintenance is careful transportation and handling of the drill. Housings or cases are delicate therefore drills should never be dropped or laid down carelessly anywhere. In the shop of one coal company at least a dozen $26 drill cases were observed needing repairs due to being dropped into cars or thrown down in the gob. Open-type drills, especially, should not be laid down in coal dust. To start or run them in that position, furthermore, allows the internal fan to draw dust and small particles into the commutator, with resultant wear and sparking. Electric shock is the rude instructor that teaches most men to keep drills out of water.

Thread bars are particularly susceptible to damage by dropping or rough handling. Any burrs on threads should be dressed off immediately with a fine file. With mounted drills, assembling posts in proper alignment to prevent bending thread bars saves wear and strains on the case, gears and motor. Short starting augers (usually not over 5 ft.) favor the thread bars and reduce destructive vibration. It is especially important to stop the drill before the end of the thread bar reaches the hub.

Good voltage is required, of course, and if the cutting machine that works the place receives even fair voltage, the drill, if operated alone, is quite likely to be adequately served because of the much smaller load. With d.c. substation voltage adjusted to 275, face voltage at the drill should not drop below 250. With three-phase a.c., 240 volts at the transformers, the face voltage should not drop below 215.

As the business of the drill is to cut and bring out the cuttings, it goes almost without saying that sharp augers tremendously reduce the wear and tear on the drill. Conveyor-type augers and heads accommodating throwaway bits speed drilling and ease the duty.

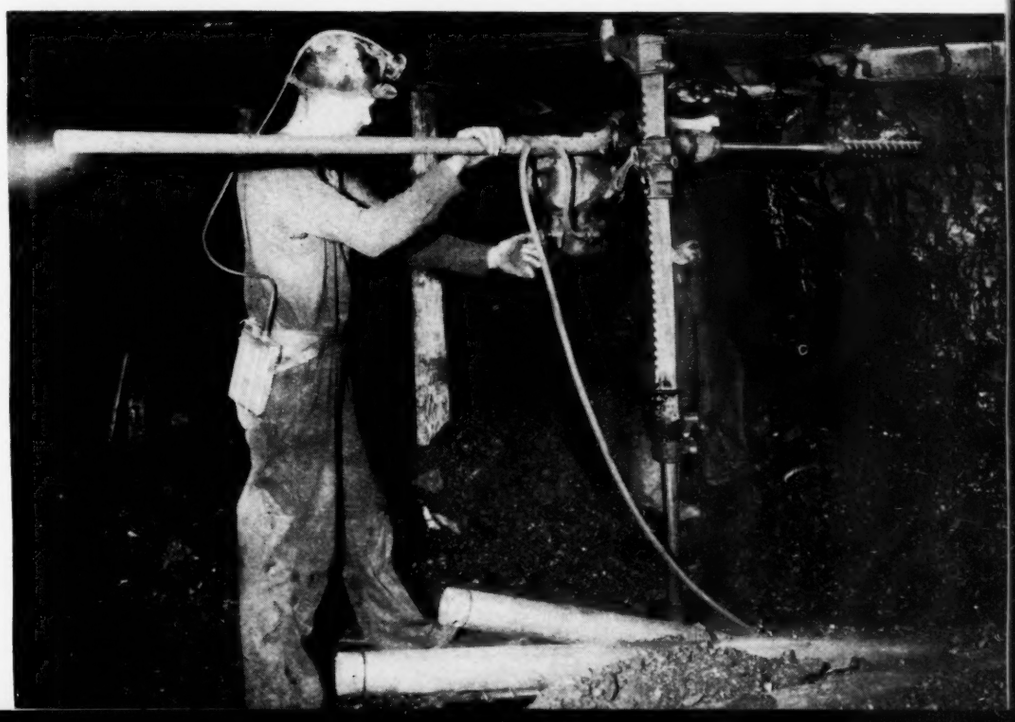
Lubrication of the electric drill includes two "don'ts." The thread bar should not be lubricated because the threads will collect dirt, which interferes with closing the liner. Pressure-gun fittings should not be added to the gear cases, especially the motor gear case, as they will result in overlubrication and forcing grease past the seals and into the motor. Daily lubrication need consist of only a few drops per shift on items such as clutches and safety sockets. The high-temperature grease packed into gear cases should last between the overhauls—say three months to a year apart, depending on service and shifts worked.

Care of rubber hose feeding percussion air drills has moved into the spotlight. Above all, sharp kinks and crushing are to be avoided. Without showing outside damage, abuse can start a progressive deterioration that brings a failure. Few lengths of hose wear out uniformly as they should but instead fail in spots that have been abused.

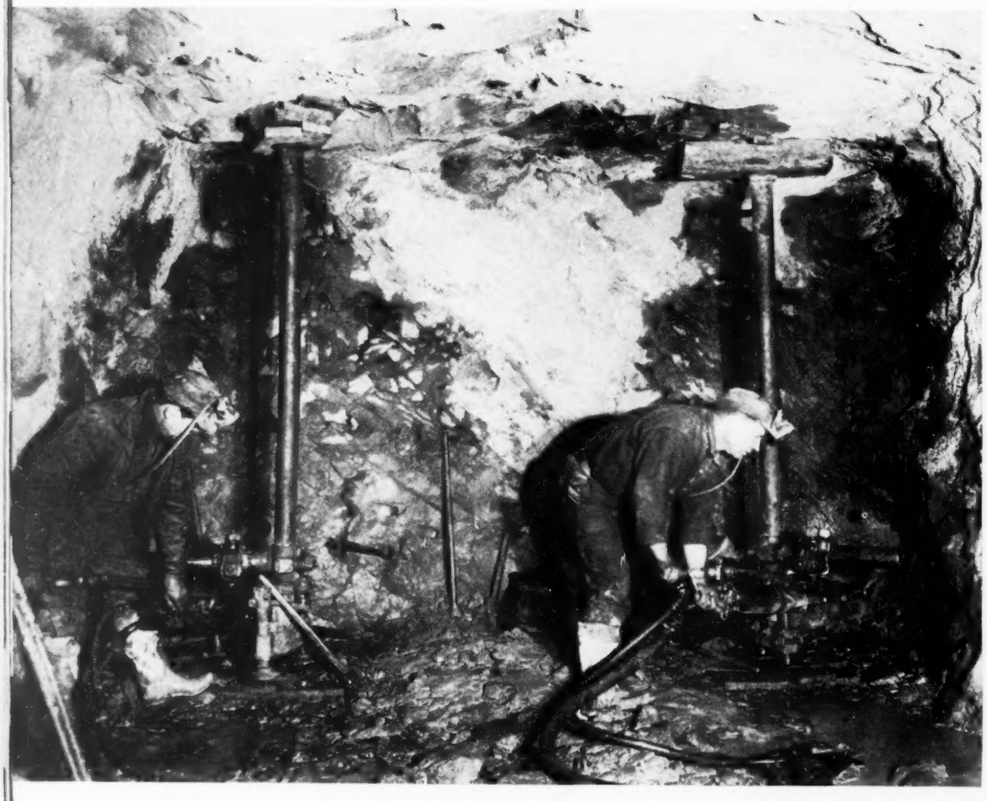
Hose couplings with shanks of a size that if lubricated go onto the hose with a fairly easy push of the hands (with the coupling held in the vise), and that are free of burrs or projections, are important in prolonging life of the ends. The lubricant should never be an oil, which will affect the rubber, but instead should be shellac, liquid soap or rubber cement.

Drill service and maintenance cost go up in proportion to dullness of the bit point, to say nothing of the greater labor cost of drilling and increased air used. Detachable bits with proper grinding equipment to rework them two or three times to smaller sizes with good form and clearance constitute the modern solution. To obtain the best possible service from

All electric drills require careful handling. They should not be dropped into mine cars or onto rocks.



Electric coal-drill repair department in a new central shop.



With air drills, water pressure should never be greater than air pressure. Otherwise, lubrication is destroyed.

detachable bits, keep an eye on the following: (1) use of a little heavy oil on the threads so the bits will come off easier and loosen tight bits by judicious hammering on an anvil with a soft steel or copper hammer, (2) use of straight rods with bottoms properly formed so that the ends are square, corners rounded, threads concentric and ends not too large in diameter and not so short as to put strain on the threads.

Hollow-steel rods with integral bits should be forged at not under 1,650 deg. F. and should never be heated above 1,950 deg. From the 1,650-deg. temperature the ends should be cooled slowly in lime or other heat insulator. The bit should be hardened by reheating to about 1,440 deg. and quenching in ½ to 1 in. of flowing cold water or a solution of 5 lb. of salt per cubic foot of water. Shanks for a distance of 2 in. should be reheated to 1,550 deg. and quenched in oil; not in water. Oil furnaces are preferable to coke forges because of better temperature control and less likelihood of injuring the steel. Ends of shanks must be true and square or drill pistons will likely be damaged. If they are too soft, upsetting takes place with resultant sticking and if they are too hard they spall the piston. Shanks too short reduce the force of blow struck by the drill and if too long they shorten the piston stroke, both slowing drilling speed.

Drill Lubrication Important

Drills must have a constant supply of lubricant and if they are getting a sufficiency, the oil will show on the drill-steel shanks. Because integral lubricators need filling every 2 to 4 hours and thus are liable to neglect, air-line lubricators are preferable. In the latter case, an oil-resisting hose is required for the 12 to 15 ft. between lubricator and drill. The oil used should offer resistance to being washed away by water but run freely at 32 deg. F. because expansion of the air causes rapid cooling at certain points in the drill. When water is used in drills the feed pressure should never exceed that of the air and the sealing rubbers and water tubes of the drills should be kept in tip-top shape. Use of water traps in the air lines simplifies lubrication. Lack of lubricant, besides causing wear, may heat the piston until the steel is softened and start cracks that develop into breaks.

Air contaminated by scale from pipes is likely to clog drills and cause abrasion of the parts. Lines should be blown out regularly and in some cases it pays to tap the pipes beforehand with a hammer to loosen scale. As far as possible, only pipes with good internal conditions should be used.

Once every few shifts all nuts on a drill should be tightened. Drills should not be run until they fail, but at regular intervals, according to service, should be dismantled, washed, inspected and repaired. The washing should be done with kerosene and the passages cleaned. Scored surfaces should be honed. Worn chuck bushings should be replaced so that the drill steel will be held straight, thus saving pistons from breakage by blows concentrated at one point.

LOADING MACHINES

Fewest Delays and Minimum New Parts Are Objectives — Lubrication, Inspection, Reporting Vital — Inspection Best Guide on When to Overhaul—Spare Assemblies for Repair and Rebuilding Speed Loader Overhauling

THE FEWEST possible delays in operation now comes first in loading-machine maintenance. Keeping the machine going with the fewest possible purchases of new parts and materials should be the second objective, perhaps now ranking ahead of low over-all maintenance cost. Where in the usual range of 3 to 8c. per ton the long-term maintenance cost, including cables, lubrication and inspection, should fall depends on many factors, such as type of machine and loading conditions.

As with other types of machinery, lubrication can never be neglected without ill effects. The best job is done by specialists; that is, greasing or servicing crews working under the maintenance department, but in the smaller mines using but a few loaders this may be impractical. At such properties, therefore, the loader operators themselves must be trained to do the greasing.

Coal Age has surveyed loader lubrication in several coal fields in the last few years. At most of the larger mines in southern Illinois, for example, loading machines are lubricated by maintenance crews during off-shifts rather than by the loader operators. At about half of these larger mines the lubricating crew also inspects and repairs. Special pressure-pump lubricating trucks were used regularly at two of the largest mines. In northern West Virginia, where the mines as a rule are not as large, they are divided about 50-50 on the question of who does the lubricating. Where maintenance men may lubricate they usually combine that work with routine inspection.

Greasing crews always should be required to report on a form the quantity of lubricants used on each loader. Meters on greasing trucks facilitate accuracy and these records serve not only to check the crews but also as an indication of the general condition of the machine bearings.

The results of daily inspection and also repairs to each loader, whether by a greasing and servicing crew or other maintenance men, should be reported on a form or slip filed with the chief electrician. Thorough inspections, including many internal parts, should be made at least once a week by the chief electrician or other specially trained man. Having a mechanic or electrician make repairs and adjustments at the same time as the inspection facilitates a more thorough check and saves duplicating work in removing covers. This is especially true with permissible loaders.

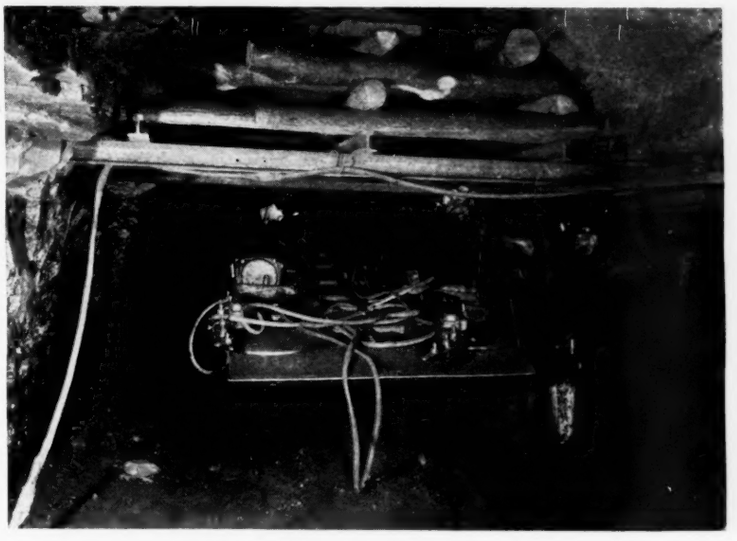
Where the mine works three shifts, special and varied methods of lubrication, inspection and repair must be inaugurated. Lunch periods and times between shifts may be utilized or, with a well organized maintenance crew equipped with lubricating and repair trucks, the machine may be stopped 10 minutes or so during shift.

Care of motors in general is treated in an article starting on p. 105, and the motors of loading machines offer no exceptions. Brushes and commutators on d.c. motors and air gaps on a.c. motors are the points requiring frequent inspections. With d.c. substations adjusted to 275 volts, the working voltage at the loader should not be below 250. With a.c. and 240 volts at the transformers, voltage at the loader should never drop below 215.

In the case of the drum controllers and reversing switches on semi-magnetic controls, fingers with blisters should be dressed lightly with a fine file and a light grease, such as vaseline, applied sparingly. Magnetic contactors should not be greased and dressing of tips with a fine file should be done only if there are large blisters, not just because the contacts are rough. An article beginning p. 108 deals with controls in general.

Keeping a few repair parts such as hydraulic hoses in the working section and keeping unit assemblies on the main bottom, at the central underground shop or close to the mine portal are necessary in holding to a minimum delays from unpredictable breakdowns. Even if a spare loader is on hand, unit assemblies already rebuilt are necessary for getting the displaced machine back into good condition as soon as possible. Otherwise, the advantages of having a spare loader are nullified to a large extent.

Special low-decked small-wheeled trucks for carrying crawler loaders



Greasing a loader during a lunch period.

to the shop for repairs save a lot of time and wear and tear on the machines.

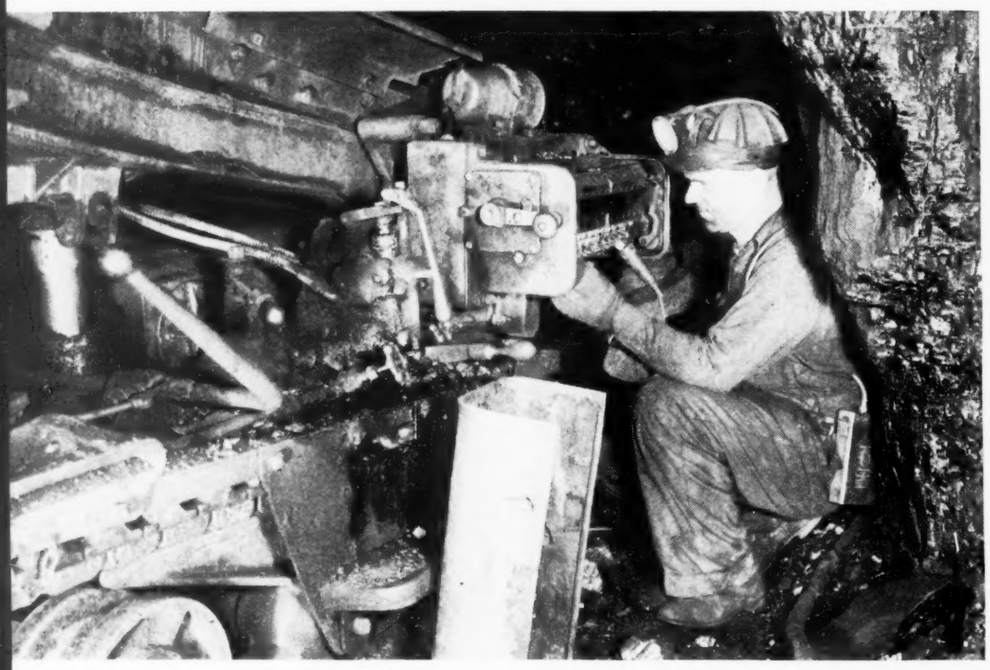
Before taking up general overhauls it is in order to say a few words about proper use as it affects maintenance. A loading machine is for loading and not for cutting and digging. The more digging a loading machine is called upon to do the higher will be the maintenance. Handling extra large lumps of hard blocky coal and using the machines in places so low that lumps catch between discharge conveyor and roof also are particularly damaging. If possible from the market standpoint, the coal should be shot and rolled out so the machine has about as easy a job as loading from a stockpile.

More effort should be made to absorb all the knowledge and experience manufacturers' demonstrators and service men are able to pass on. It is important that section foremen and the loader supervisor, if one be employed, also learn all the tricks so that they will be better prepared to teach new men in case those trained by the factory men leave the job.

The time for giving a loading machine a general overhaul is best determined by inspection. However, from tonnage, shifts worked and maintenance and delay records accumulated at a particular mine it is practicable to establish a limit of a certain number of shifts or tons handled.

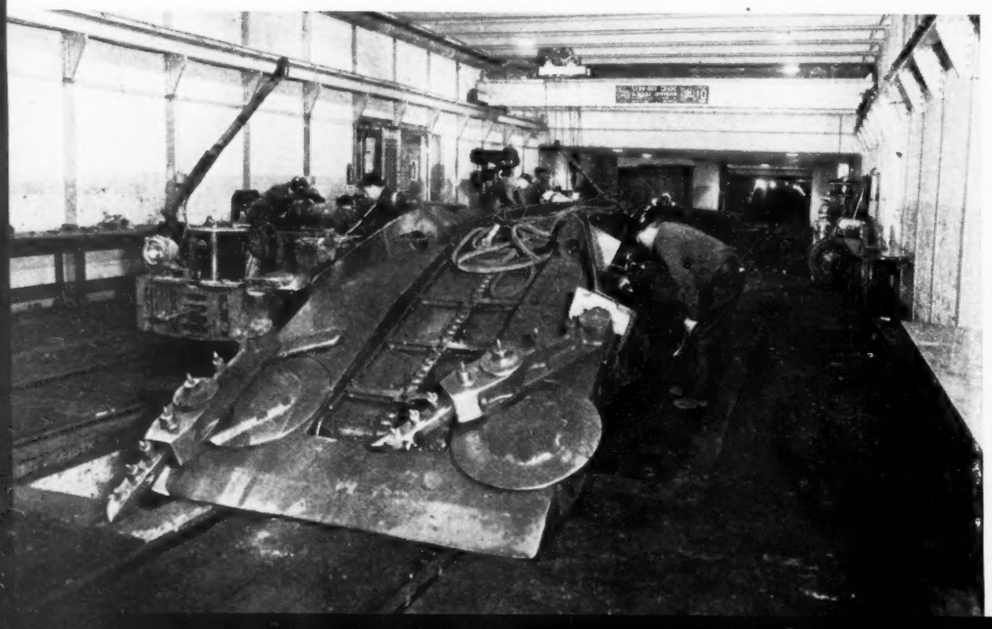
When there are a number of machines of one type at a property and there follows the usually economical practice of keeping spare assemblies on hand to be repaired and rebuilt during regular working hours in the central shop, a whole machine can be rebuilt in a week or so. Except for certain repairs that may be necessary on the frame, trucks, cats, etc., the overhaul then consists principally of dismantling and assembling. Following this procedure, one company which operates twelve track-type machines equipped with manual electrical controls and without hydraulic systems reports that total overhaul costs average approximately $1,600, including complete rebuilding of the front conveyor booms.

Before beginning to dismantle a loader for the general overhaul it should be given a thorough cleaning outside the shop or in a special cleaning room. All dirt should be blown off ledges and out of corners with high-pressure air. Accumulations of greasy dirt should be scraped off and perhaps some parts of the machine washed with a grease solvent, such as carbon tetrachloride.



Controller undergoes a check while the crew takes on a little food.

Loader in an underground shop for weekly inspection and repair. This shop is three miles underground and close to the workings.



Hydraulic Care Needed

The oil hydraulic system used on a number of loaders provides smoothness of operation, finger-touch control, freedom from shocks and a simplicity of moving parts that aids maintenance but introduces some new problems. Oil must be kept scrupulously clean, free of water and air. To avoid oil wastage and make it easier to keep the machine clean, oil leaks should be repaired without delay. Guards should be kept over plungers and in any maintenance work where plungers are dismantled or handled, care should be exercised to avoid denting or scarring which would cause damage to the packing.

Hydraulic systems require a light oil; about S.A.E. 10. Mechanical filters should be turned once a shift and filters of cartridge-type units washed as often as is necessary to keep the oil so it has a bright appearance. A leak in the intake will pull in air or even water if there happens to be some dripping or accumulated thereon. Either air or water may cause foaming, but some machines have a filter to remove air. Oil pumps operate with very small clearances and require careful workmanship if they are overhauled locally. Shops undertaking this work should have a test unit comprising motor, reservoir, piping, valves and gage to check the pumps after rebuilding.

CONVEYOR EQUIPMENT

Usual Maintenance Methods Apply to Motors, Controls and Auxiliaries—Good Installation Necessary With All Types—Care in Installation and Operation Especially Necessary With Belts—Men Always on the Job Helpful

BUILDING low maintenance into their products is the goal of all manufacturers of mining equipment, and producers of underground conveyors are no exception. To realize the benefits of this forethought, however, care in installation and operation is necessary.

Conveyors used underground normally fall into three classes: chain-and-flight, shaker and belt. The power almost invariably is electric, either a.c. or d.c., and the drives naturally include the motors, with the necessary controls, gearing and/or speed reducers as required, plus couplings, roller chains, etc., depending upon the drive. Lubrication (see p. 75) naturally is a vital factor. Regularity and observance of the recommendations of the equipment manufacturer and the oil companies are good ways of obtaining efficiency in this respect.

Proper Voltage Necessary

Maintenance of motors and controls on conveying equipment is substantially the same as in other applications. These subjects are treated on pp. 105 and 108 of this issue. Cleanliness, keeping drives out of dust, mud and water, and regular inspection and running repairs by competent men are as valuable with conveyor drives as with other equipment. Proper voltage also is essential, the rule being not less than 250 volts d.c. at the motor with 275 volts at the substation and not less than 215 volts with 220-volt motors and 240 volts at the transformer taps.

Proper installation is one of the best ways of insuring low maintenance in conveyor operation. With chain conveyors, the drives should be level, at least across the conveyor line; properly aligned; and firmly anchored. The pan line should be perfectly straight to prevent excess load on the motor and wear and tear on the equipment. Chain conveyors, however, sometimes are deliberately curved to facilitate reaching one end of a face or to get them closer to a pillar. While such curving can be done, it is not conducive to low maintenance.

Sharp breaks or changes in vertical direction of the pan line should be avoided, and frequently it pays to block up lines when going through swags or on both sides of a hump. Every attempt should be made to keep the chain or flights from catching or being caught. Proper chain tension helps in this respect, in addition to other benefits.

Firm anchoring and leveling both ways also is essential with shaker-conveyor drives. Leveling crosswise of the pan line is especially essential to prevent strain on the drive mechanism. If it is necessary to block up drives, the timbers or planks should be laid crosswise. The bottom should be leveled in all cases. Tightening the jacks and checking for level and motion should be a regular chore for the section boss or maintenance man. Where drives will remain in one place for long periods of time, concrete foundations have been found a paying investment.

In installing a shaker drive it should, of course, be lined up with the troughing. Pans should be kept on line and tightly fastened together, as an uneven line throws an extra strain on the fastenings. In setting up a line, sharp vertical breaks or bends should be avoided. If the bottom is uneven, light guide frames should be used to prevent jumping or buckling. And if the line is supported by carriages, steps should be taken to insure that they are correctly placed, well anchored and are functioning at all times.

Care should be taken with all types of conveyors to see that more pans than the motor can carry, considering load, grades, etc., are not added on. With shaker equipment, grades increase or decrease the length of the pan line. If angle troughs, duckbills and similar auxiliaries are employed, a corresponding reduction in pan line normally is recommended by the manufacturer. And in most cases, where the pan lines exceed a certain length, the drive should be moved back from the end a distance equal to the excess length.

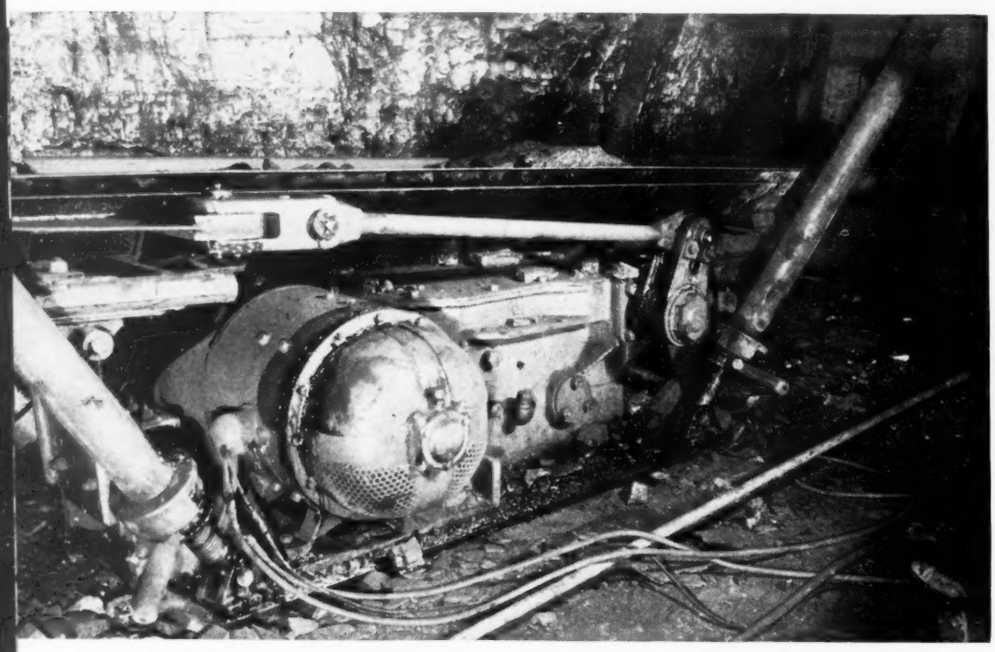
Alignment and leveling are particularly important with belt conveyors. Otherwise, the belt invariably runs, or tries to run, off the idlers. Training idlers may be installed to prevent this, but correct alignment and leveling in the first place are the real answer. Preferably, sights should be set with a transit to facilitate alignment. On permanent installations, such as on main lines and in slopes, preserving level and alignment is not difficult once the equipment is set. With temporary installations, these conditions should be checked regularly. Failure to cut the ends of the belt square in making splices is another cause of belts running off center, along with sagging of supports, damage resulting in stretching on one side or another and loading to one side or the other. Belts always should be loaded near the center.

Attention Helps Belts

Belt-conveyor drives, like other conveyor drives, should be firmly anchored. Plenty of headroom over the top (5 ft. is recommended by one manufacturer) should be provided, and the main belt line should be protected against falls. Idlers should be in good condition and turning freely. Careful lubrication is essential if lubricated-type bearings are employed, and some operations find a full-time oiler and clean-up man a paying move. Oil or grease, of course, should be kept off the belt. Return rolls should be kept clean to prevent the belt running off to one side and also prevent coal being carried into the tail pulley. Belt tension should be checked regularly and adjusted as necessary to provide just enough tension to handle the load without slippage.

Metal splicers normally are employed on mother belts underground, and these should be of the correct size for the end pulleys. Splices should be examined regularly to see if they are in good condition, as a loose fastener can result in substantial belt damage. On permanent belts, vulcanized splices are much to be preferred. Vulcanizers may be purchased or made at the mine. Such equipment also is highly recommended for repairing belt edges and patching torn places, although self-vulcanizing cement and plastic rubber compounds are available for certain types of repairs.

Firm anchorage, straight pan lines and no sharp breaks help with chain units.



Shaker drives especially require firm anchorage and careful lining up.

Alignment, leveling and belt care cut conveyor-belt maintenance cost.

One coal company reports the cost of a vulcanized splice as $17.80, compared with a four-year cost of $147.20 for metal fasteners (26-in. belt). Also an 1,800-ft. 48-in. 8-ply refuse belt, installed in 1932, was badly damaged a year later and ordinarily would have been replaced. But with over 50 vulcanized repairs, the belt still is in service and should continue for another year.

All maintenance plans, however, should provide for regular and thorough belt inspection to uncover bad operating conditions and make possible stitch-in-time repair work. Iron of all kinds should be strictly taboo, and every possible attempt should be made to keep it out of belt systems or remove it as quickly as possible. Belts on the outside should be housed to keep them out of the sun, as well as prevent exposure to rain and snow. Extremely low temperatures should be avoided, if possible.

Loading Point Critical

The loading point on any belt conveyor nearly always is the critical point, as here the belt receives its major abra sion and practically all its impact. The ideal condition is to have the material pass from the feeding equipment to the belt at the same speed and direction of travel with minimum impact. On permanent installations, feed chutes should parallel the belt, and should be veed out or equipped with fingers, grizzlies, etc., for center loading and putting fines on the belt first. Rubber-cushioned or pneumatic idlers are increasingly used to absorb impact at loading points on permanent belts.

Special chute and impact provisions, of course, are pretty much out of the question with the usual mother-belt installations underground. However, there is still much that can be done to smooth this operation. Locating the end of the room conveyor so that a load idler is some 4 to 6 in. behind is helpful in supporting the belt at the point of greatest impact yet enabling it to cushion the fall of heavy material. The end of the room conveyor should be placed so as to avoid loading on one side or the other. Sufficient clearance should be provided over the belt to insure that lumps or other material coming from the back will not hang up. Skirt boards should be used sparingly, if at all, and should not result in edge wear.

To prevent a pile-up as a result of a belt break or to prevent damage at times when the driving pulley slips due to moisture, etc., without starting

the belt, roller switches and electrical interlocks have been found quite worth while.

Belts may be severely damaged even before they are applied. Belts never should be dropped when rolled. If they must be lapped in moving or installing, the bends should not be sharp enough to result in undue strain. Other hints might be given, but careful handling should be the rule at all times.

While maintenance and repair of conveyor equipment is simpler in some respects, it is more of a problem in others. Where the conveyors discharge individually to cars, a good opportunity is afforded for the men to get at them for inspection and repairs, and for delivering the necessary parts.

Where gathering or mother-belt conveyors are used, however, the problem becomes a little tougher. Conveyors by their nature are not readily portable, as they are designed to remain in place until the rooms or territories are finished. Also, it is more difficult with gathering or mother equipment to deliver the heavier parts that might be needed to handle a breakdown, although hand trucks, crawler towing equipment and power-operated crawler or wheeled trucks offer possibilities for easing such work and have been used quite successfully by a number of operators.

In view of the conditions just recited, and depending upon the size of the conveyor unit and the equipment involved, at least one and often two men are assigned to a section for inspection, repair, lubrication, etc. When not engaged in such work, such men may extend or shorten conveyors, help in moving and handle wiring and electrical distribution. Where mother belts are employed with several conveyors feeding into them, some operators, as noted previously, employ an additional man for lubrication and clean-up.

Keeping an adequate stock of spare parts in the working section is especially desirable in conveyor work because of its nature. Even in the case of larger items, such as motors, reducers, etc., spares close to the section are well worth while. Where two or three mother belts, gathering conveyors and the like are in service reasonably close together, one set of such spares could be kept in a central location, thus reducing the investment. But if only one belt, etc., is in operation, the proportionably higher investment in spare equipment might be returned if only one long breakdown was forestalled.

MINE LOCOMOTIVES

Opportunities for Improving Old Locomotives Are Many —Better Operating Practices Cut Maintenance—Regular, Careful Inspection and Lubrication Necessary—Everything Should Be Torn Down in the Periodic Overhauls

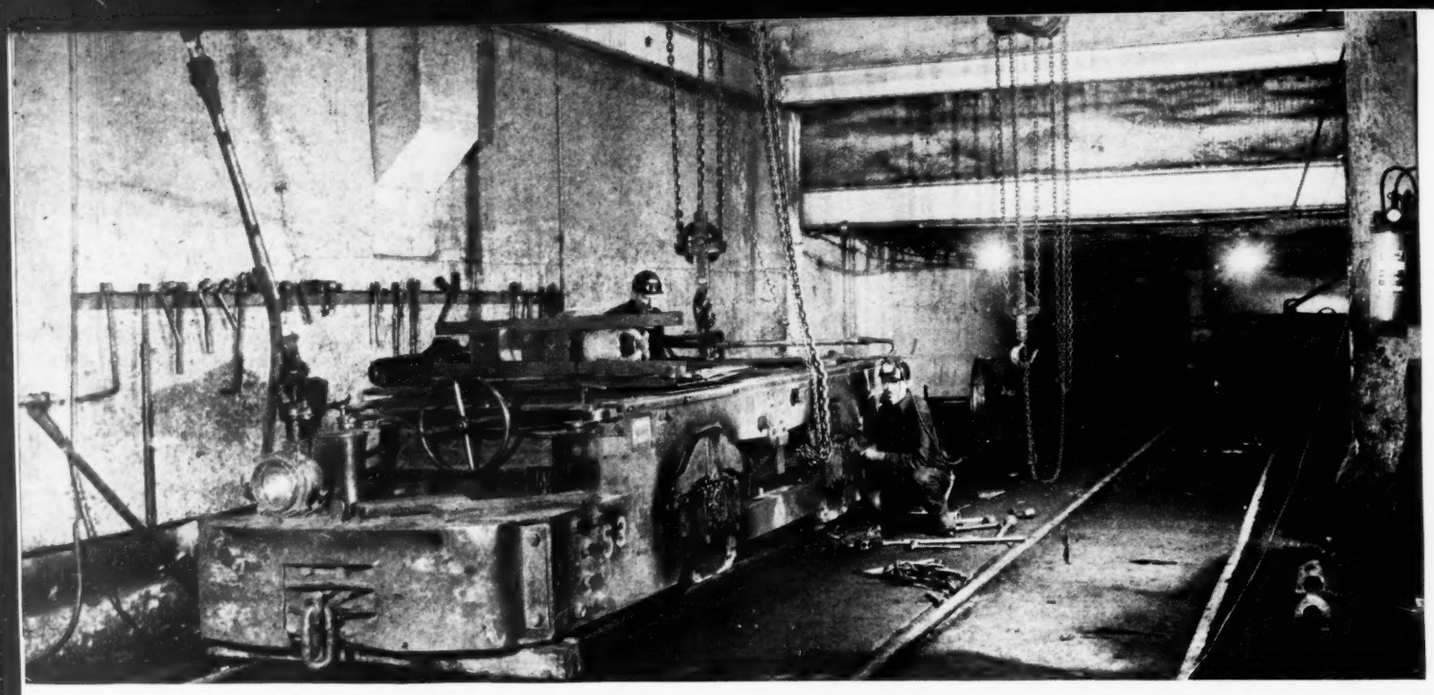
MINE-LOCOMOTIVE cost shows wider variations than any other underground machinery. This is principally due to the tremendous differences in construction between the 10- to 40-year-old units that have not been modernized and locomotives of latest designs or which have been rebuilt to incorporate most of the new features. When modernization cuts over-all locomotive maintenance cost from 5 to 2c per ton, another large saving is bound to result through reducing operating delays.

An early step in any program to improve locomotive maintenance obviously should be rebuilding to include as many improvements as are practicable under the circumstances. The principal possibilities are: (1) armature bearings—replacing sleeve with antifriction and using double-row or roller types on the pinion end; (2) continuous strip or punched-plate resistances for grids; (3) heat-treated gears; (4) automatic transfer switch on the cable-reel type; (5) covered axle bearings, grease sealed; (6) changing control to ground potential; (7) asbestos- or glass-insulated coils; (8) gearless cable reels; (9) tapered roller-bearing journals; (10) improved drum or contactor control; (11) hydraulic brakes; (12) addition of blowers; (13) thermostatic motor protection; and (14) possibly adding chains between axles if the locomotive has been converted to low speed by connecting motors permanently in series.

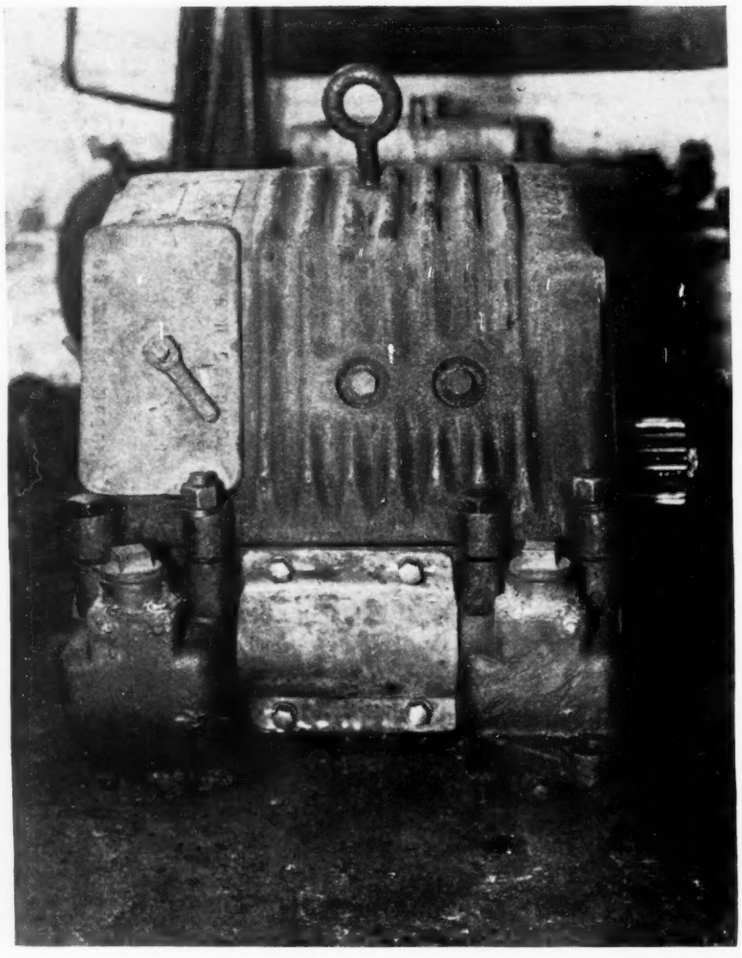
It is granted there may be sufficient reasons such as lack of capital, short remaining life of the mine or difficulties in obtaining new materials and therefore numerous plain-journal-bearing locomotives must continue in service. Gear and pinion life depends largely on maintaining these journal bearings, and those on the axle, in good condition. With endplay in trucks and improper meshing of the gears, life of the latter may be one year against ten years or more if these bad conditions are eliminated by taking proper steps.

Changing the old unsealed double-brass axle bearing to a type which can be properly lubricated and kept clean is a job which need not cost unduly. A heavy plate cover can be bolted over the axle space between boxes, thus closing two former entrances for dirt. The space under this cover is packed full of grease and, as it tends to work out through the boxes, it hinders dirt entrance at the outside ends. The hinged covers of axle boxes, usually a dirt inlet, can be replaced by welded nipples and pipe plugs.

Part of the maintenance man's job is to work with the locomotive operators, foremen and even the superintendent to reduce operating abuse. Resistances are designed only for starting and stopping. Therefore, locomotives should not be run very far on points. Reversing while in motion ("plugging" or "goosing") instead of using brakes is abuse unless the locomotive is especially designed to permit it. Frequent and prolonged slipping of wheels means ridiculous overloads. Habitual slipping of wheels in starting reasonable loads spells resistances or connections out of kilter or a poor motorman. Applying brakes to keep wheels from slipping at starting indicates a similar condition. Sand should be used sparingly. The disadvantages of too much



Journal trouble being eliminated for at least ten years by installing tapered roller bearings in place of old brasses.



Axle cover added and dirt-leaking hinge axle-box covers replaced with nipples and plugs.

sand are poor contact, more pull required to handle the trip and added wheel-tread wear.

Tire and wheel-tread maintenance has come rather extensively to arcweld filling although a number of prominent companies still turn tires and treads on steel wheels. Some mine officials object to welding on the score of safety; others think the possible savings are small, especially those who by test or opinion brand the welded tire as wearing much faster than a new tire. Welding of tires is treated as a separate subject (p. 99).

Regular Inspection Necessary

One of the new locomotives "that has everything" should not need inspection by a maintenance man oftener than once a week. Most, however, need a brief daily inspection to detect and nip in the bud certain troubles such as electrical overheating or indications of lack of lubrication. Once-a-week inspection for the ordinary locomotive should be a thorough going-over including opening the controller, looking into the motor, checking the resistor for loose connections, looking for loose bolts and trying out the brakes and sandrigging. Most companies find it economical to dress off with a fine file any blisters found on controller fingers, while others see economy through greatly reduced delays in renewing once a week any parts that are damaged. Some of the latter likely will revert to the dressing practice for the duration.

Between weekly inspections and the periodic general overhaul once a year (stretched to three years in some cases) comes the necessity of checking the anti-friction armature bearings. Four times a year is enough for usual service

and greasing these bearings that often should suffice. Lubrication of the remainder of the locomotive should be assigned to the motorman. Plain wool-waste-packed journals need oiling at least once a day with a heavy engine oil (about S.A.E. 60).

Keeping the locomotive reasonably clean—for instance, blowing dirt out of the resistance pocket—usually is a weekly job. Dirt most anywhere hinders inspection and in some places can cause damage. In the resistance it can cut off ventilation and by getting wet may cause grounding or shorting of the resistance. It is important that resistances be guarded against any metal objects dropping into them. A complete housing of perforated plate is effective.

On the periodic one- to three-year general overhauls practically every bolted or screwed part of the locomotive should be dismantled, inspected, repaired and painted. Unless the frame is in bad condition, cost of labor for the job should not exceed $200. Preliminary to bringing the locomotive into the shop for dismantling, it should be cleaned thoroughly with a strong jet of high-pressure air.

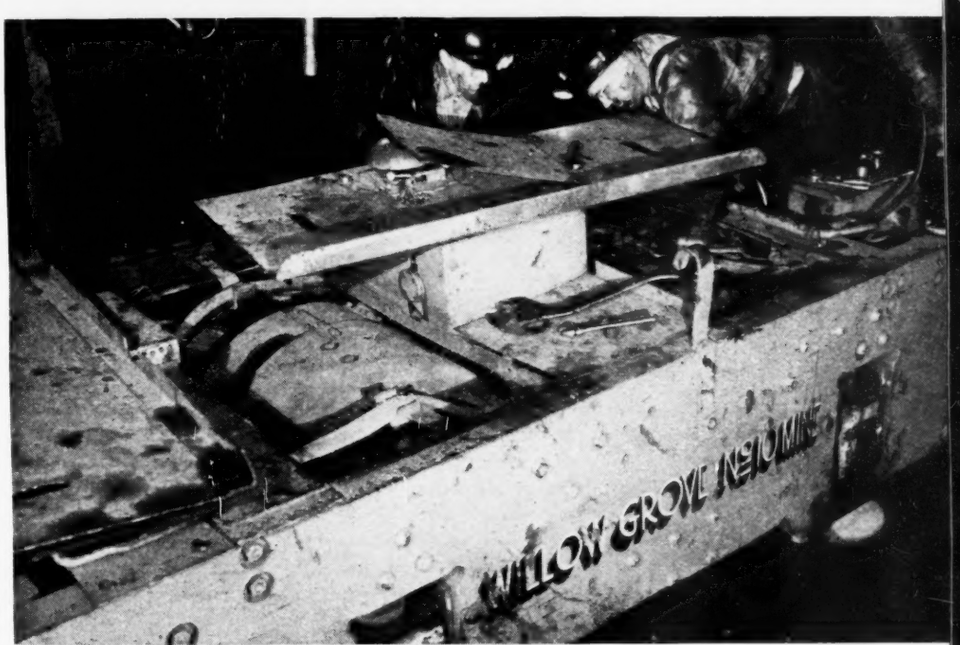
Adjusting brakes on blower-cooled main-line locomotive during weekly check.

Check Field Coils

If a motor pinion is to be removed by the wedge method, double wedges properly greased should be used on each side and preferably tightened by two men tapping simultaneously with light hammers. When overhauling the motors the field coils should be removed, checked for shorted turns and then painted with a red-oxide varnish. The same paint should be applied to the inside of the motor case. If grooved appreciably, the commutator should be turned and the mica segments undercut.

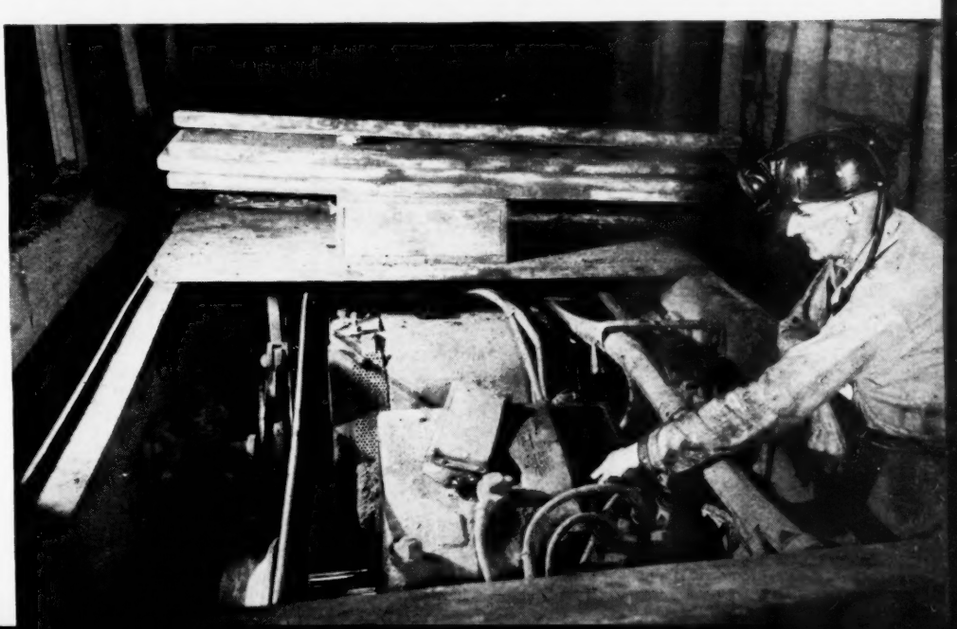
Heat, oil and vibration, the causes of most wiring troubles on locomotives, are not especially difficult to combat. Special wires with heat- and oil-resisting insulation should be used and, if not protected over the long runs by sections of conduit or duct, should be clamped at frequent intervals. Terminal connections made in the best possible manner, perhaps brazed at resistances, and all connections kept tight by frequent checking will save wires from insulation damage near the terminals.

Sliders instead of trolley wheels bring freedom from sparking and much lower pole-head cost, assuming that no wheels are used on the trolley wires to cause pitting and that wires are lubricated, preferably with a graphite preparation (p. 78).



The general overhaul on this mine locomotive included complete rewiring with heat- and oil-resistant cables.

This chief electrician makes a personal inspection at least once a week.



MINE CARS AND TRACKS

Better Wheels, Bearings, Suspensions, Hitchings, Steel and Designs Cut Car Maintenance—Car Repairing Needs Good Quarters and Ample Tools—Low Maintenance Can Be Built Into Track—Regular Attention Helps Condition

EXPERIENCE and operating failures are successful guides to better mine cars, whether they be made of wood, steel or a combination of the two. While all elements in mine-car design and materials have shown improvements, wheels and bearings have perhaps outstripped all the others.

A recent survey of practices at several mines using 4- to 6-ton cars indicates some of the characteristics favored in car construction, and believed to reduce maintenance. These include:

1. Use of cast- or rolled-steel wheels by a number of operators on the grounds of light weight and resistance to breakage.

2. Many operators favor chilled-tread cast-iron wheels because of smooth rolling and reduced tractive effort. With spoked wheels, it is pointed out, correct design and treatment are required to prevent soft spots where the spokes and tread join, eventually resulting in flats. One mine with extensive experience favors solid webs for cast-iron wheels instead of spokes, on the ground that the chill can be better controlled. Overchilling causes flanges to break. Wheels, however, come in a variety of designs, providing a large selection to suit individual preferences and operating conditions.

3. Anti-friction bearings are preferred, with the tapered-roller type in the majority. One mine using both pointed to a good grease seal as being the important feature in an anti-friction bearing, and reported that after three years of operation on one greasing, ball bearings were in an excellent condition. Both labyrinth and laminated seals are used, each having proved satisfactory.

4. Large cars usually are fitted with spring drawbars or spring bumpers. These protect the entire car structure.

5. Improved hitchings have been found to avert many wrecks, with consequent reduction in repair cost and less interruption of production. Forged heat-treated links and pins pay in the long run in most cases, especially at properties with mine-car slopes. Regular inspection and annealing of hitchings and draft fittings is both a safety and economy measure at such mines.

6. Solid-end cars used with rotary dumps or overturning cages stand up better than open-end cars. At many operations, the customary chain to keep the latter from spreading is being replaced by approximately ¾x3-in. bars, which also prevent the sides from being caved in.

7. Speed of repair is one of the advantages of wooden cars. Wood is much easier to get these days, among other things. One large mine considers its production hampered when more than 2 percent of its cars are in the shop for repairs.

8. Roof falls usually damage only the top part of the car. Body irons are quickly removed and straightened; broken wood sides quickly replaced. A folded-up steel car presents a more difficult problem.

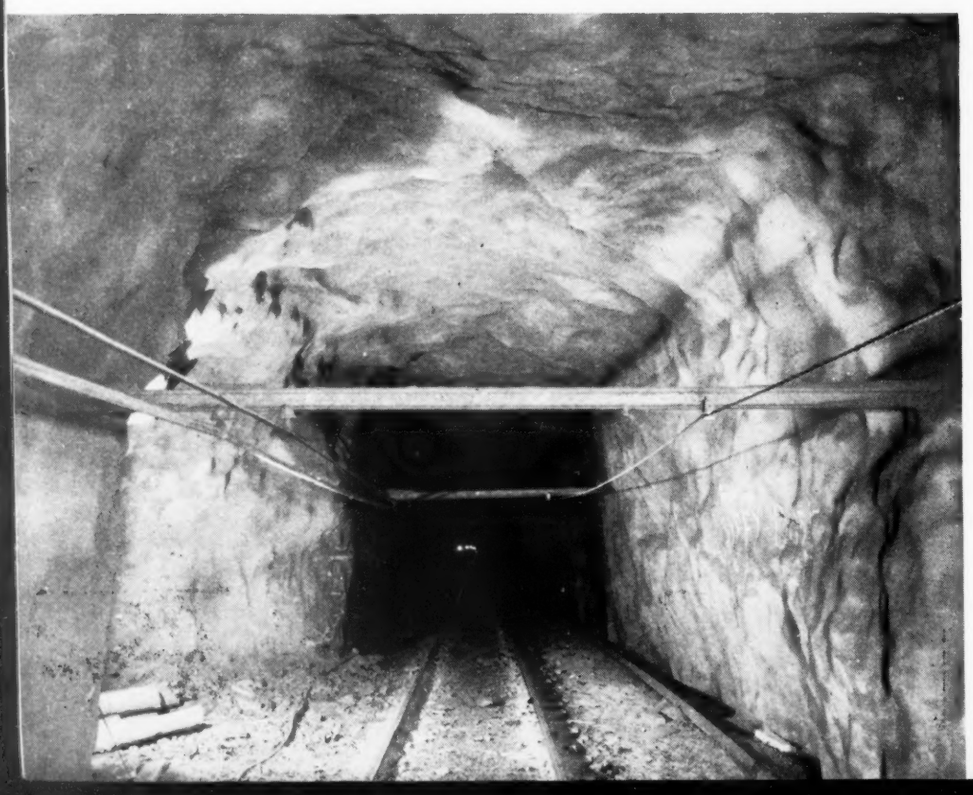
Steel Has Advantages

Normally, however, the advantages of the steel car more than offset any disadvantages such as those just cited. Among other things, steel cars generally hold more for a given set of dimensions, are more rigid and are less likely, if properly designed, to weaken under the stresses of loading, hauling, caging and dumping. Some wheel flexibility is desirable to prevent derailments, however, and many types include spring suspension, especially when large. One mine now changing to tapered roller bearings uses the axle hanger shown in Fig. 1 to provide for some vertical movement of the axle. Similar arrangements are used by other properties, in addition to springs, etc.

Rust is one of the greatest enemies of the metal mine cars as well as the metal parts of wood or composite cars. In normal times, one preventive is the use of corrosion-resisting alloys, many of them also offering resistance to abrasion as well as a substantial decrease in weight. One company has designed its cars, originally built of plain carbon or copper-bearing steel, to incorporate a corrosion-resisting bottom (Fig. 2). Finding that falls were most damaging to the upper two-thirds, the new body was designed so that the top section could be readily removed for straightening as necessary.

One mine covered in the survey is

Good track and good roof support make for trouble-free haulage.



a user of wood, steel and composite cars. Design of the composite car in question is shown diagrammatically in Fig. 3. A steel bottom is bolted on top of the wood floor and a steel Z section is used to connect up with the wood sides. A steel angle is installed around the top edges to prevent damage from loading-machine conveyors and the like.

Car-shop facilities naturally vary with the type of the car and the number in use. Where wood cars are employed, it has been found quite helpful to have the lumber planed to a uniform thickness. If possible, car work should be done under shelter, with ample light and heat. Materials should be stored where it is convenient to get at them, and special handling facilities should be provided, such as a tractor crane, small wheeled crane with a hand winch, etc., for handling the heavier timbers, steel plates, etc.

Improved wheels, anti-friction bearings, corrosion-resisting high-strength steels and other features cut car maintenance.

Correct Tools Vital

Tools of the right type and in ample quantity are an absolute necessity for efficient car-repair work. In addition to chain blocks, overhead traveling cranes or similar provisions for lifting and moving cars, wood saws, air and/or electric drills and nut-runners, jacks, pullers, wrenches, etc., are among the things that a car shop can make good use of along with, in most cases, a forge, trip hammer and special facilities for bending irons and plates. Special tools may be devised to suit the needs of the individual property.

Where the number of cars is large, a relatively large investment in shop facilities may be warranted. One anthracite producer has designed special shops (January, 1942, *Coal Age*, p. 47) for straight-line production from storage shed and sill-assembly shop to main repair shop. The latter is equipped with everything necessary for efficient work, including storage facilities for parts, stands for hanging tools and easels for working on certain items such as car doors.

Several properties equipped with steel cars have found special hold-down facilities helpful in restoring them to shape. These hold-downs consist of heavy eyes in the floor at each corner of the car. These permit chaining or hooking the car so that a chain block or crane hoist can be used in bringing it back to shape.

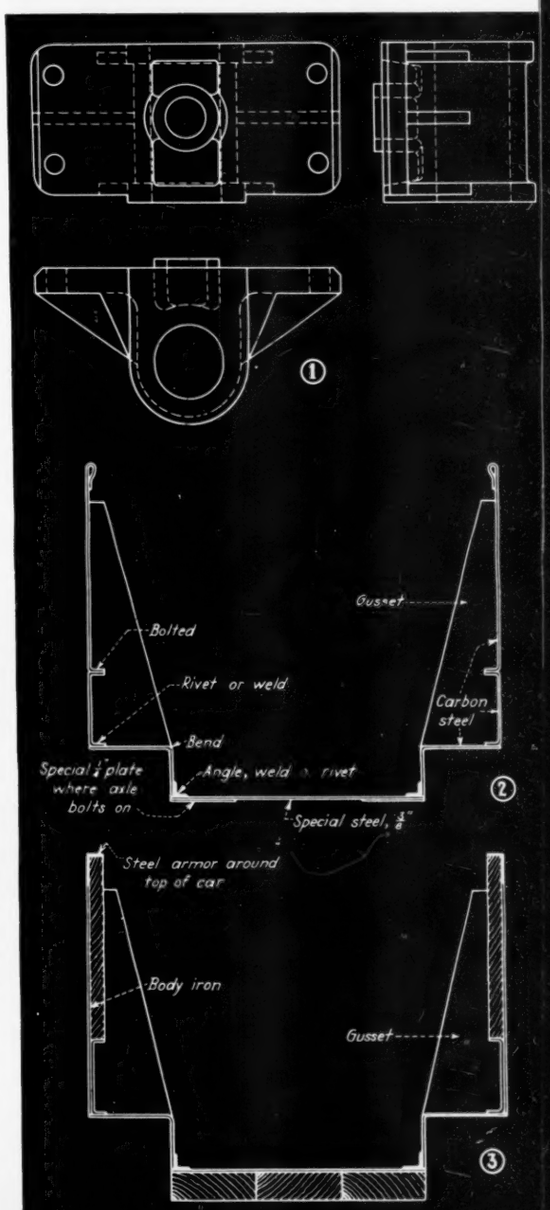
Cutting and welding equipment finds a place in practically all car-repair shops. Oxyacetylene units, of course, are valuable for cutting plates and other materials, in addition to burning off rivet and bolt heads, heating plates for local straightening, etc. The uses of arc welding are manifest, including manufacturing complete cars after purchasing trucks, etc.

Mine tracks have a substantial influence on car maintenance, in addition to offering a maintenance problem of their own. Good track, of course, is easier on both cars and locomotives, and the better the track the fewer the derailments and wrecks. The moral is self-evident.

While there are a number of things that can be done to track after it is down, the time to insure low maintenance is in its construction. The start is a straight haulageway graded as necessary to eliminate sharp dips and humps. Good roof protection is essential, which is provided by treated timber (probably the most feasible under present-day conditions), steel timbers, rail crossbars or guniting. The latter also is one of the more feasible war-time measures. Hitch-drilling has been found a highly successful means of eliminating legs and their attendant expense and hazard at a number of properties.

In actual track construction, an important factor is a good subgrade, with provisions for keeping it well drained at all times. Rails should be ample in weight, as too-light rail always is a nuisance and an added expense. Wood still is the preferred material for main lines, and should by all means be treated in permanent in-

Fig. 1—This journal allows axle movement.
Fig. 2—Corrosion-resisting car bottom.
Fig. 3—Armored-bottom composite car.



stallations. Many operators find, in addition, that a steel tie every so often is well worth while.

Rail joints should have special attention. Welding has been found cheaper and more efficient by numerous operators. If joint bars are employed, they should be accompanied by good track bolts well tightened when applied and again about a week and a month afterward. Periodic checking and tightening should then be the rule. In fact, one of the more important items in track maintenance should be regular inspection and attention to bolted joints, which should be kept up to grade and in good condition to prevent hammering. Even on temporary track, making a good joint and maintaining it in that condition is well worth while.

Steel ties are used in large numbers for temporary track, and the heavier tie, with its stronger fastenings and greater stiffness, normally will pay dividends. Conservation of materials requires that care be taken to prevent damage to such ties in use and to make sure that all injured ties are salvaged for repair, if possible, and if not, for scrapping.

Proper ballasting is a major element in keeping track in good condition. Mine material may be used, but care should be taken to see if it will do as good a job as some of the purchased materials, such as slag or gravel, which may be less expensive in the long run in spite of a higher initial cost.

Switches should be as heavy and as long as possible, the latter because short switches are not suitable to high speeds and may be a hazard where trips are long. The same applies to crossovers. In both cases, careful installation is essential. Frogs preferably should be of one of the alloys—in one-piece construction where possible. Many companies find that building up worn frogs and other track details by electric welding goes far toward prolonging life and insuring efficient hazard-free trip operation.

Maintaining any track-haulage system in good shape requires constant attention from a skilled crew. The size of this crew will vary from mine to mine or, if required, two or more may be worked. In any event, some group should be charged with constant inspection of track, turnouts, crossovers, etc., as well as joints, drainage, leveling and ballasting. An excellent method of insuring good conditions is to have motormen report the exact spot where any trouble of any kind is encountered, whether it be a derailment, pounding on joints, low spots or any other difficulties. This enables the track crew to give such spots prompt attention and thus preserve good conditions.

STORAGE BATTERIES

Cleanliness and Keeping Plates Covered Essential—Overheating Should Be Avoided—Ease Should Be Goal in Battery Changing—Balancer Set May Be Helpful in Some Cases—Keeping Charging Records Important Task

STORAGE batteries undergo tough service in mining, but if a few simple rules are followed in maintenance they usually give trouble-free service equalling or exceeding guarantees. On locomotives and shuttle cars, space limits the capacity of battery that can be accommodated. As a rule, therefore, the battery must deliver its full charge to complete the task. Vibration on a locomotive battery is severe and none too easy on a "tank" car furnishing power for cutting and loading in a "wireless" mine. One factor, the relatively low temperature of about 60 deg. F. underground, is in the battery's favor.

Cleanliness is of high importance with both the lead and alkaline batteries. Tops must be kept clean and dry. This is done by wiping with a cloth or using an air jet once a day or up to once a week, depending on conditions. Because alkaline batteries have conducting jars, particular attention must be paid to keeping them dry on the outside so there is no conducting path of moisture or wet dirt to the frame. Under many conditions it is advisable to disconnect, take out and clean alkaline cells once a year. The outside of the cell should be thoroughly cleaned, the sides and bottom coated with an alkali-proof insulating paint and the top oiled. Using a steam jet is an easy way of doing the cleaning.

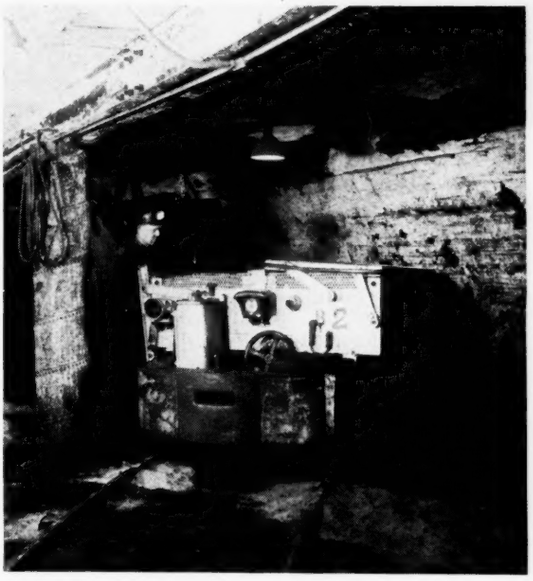
Keeping the plates covered with electrolyte is equally important with both types of batteries and caution against bringing an open flame near applies also to both. Overfilling of either will cause electrolyte to spew out through the vent upon heating or charging. To be on the safe side, use pure distilled water for filling or flushing.

Convenient filling equipment saves time, insures more regular and accurate filling and also prevents spilling water over and around the battery. An elevated tank with a hose down to the battery is a good arrangement. To serve a long line of stalls, a portable tank or can light enough to carry can be hung on pegs or ceiling hooks near the battery. A large-capacity tank can be mounted on a trolley so it can be pulled along above the batteries. For lead batteries it is especially important that the water be not contaminated by coming in contact with iron or steel. Parts of wood, glass, lead or rubber are preferred.

Overheating will cause rapid deterioration of both lead and alkali batteries. A practical limit for both is electrolyte not over 115 deg. F. in the centers of the cells. However, one manufacturer of lead batteries places the limit as low as 110 deg. F. during charging. In the factory on hot summer days, another surrounds the battery with water during initial charge and holds the temperature below 113 deg. F.

Lead batteries in mine service deliver an average of about 1.8 volts per cell, but when charging is started the voltage per cell quickly comes to 2. At the finish of charging the voltage is 2.6 volts per cell. The generator should be capable of delivering at least 3 volts per cell; for instance, 162 volts for the 54-cell battery of a combination locomotive or 351 volts for

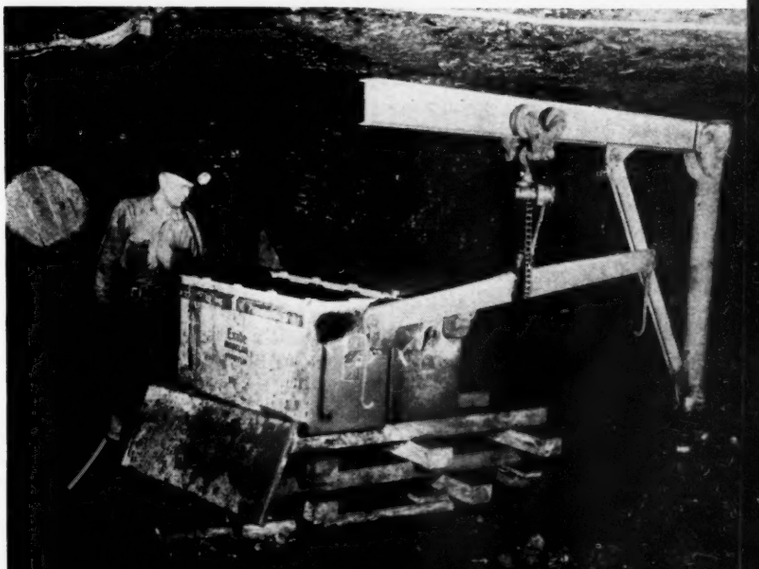
Roller transfer racks speed changing at shuttle-car station.



Checking gravity of a lead battery on a gathering locomotive.

Rotating-table charging rack for shuttle-car batteries.

Charging stall for a tank supplying power for cutting.



Ties make a satisfactory rack for shuttle-car batteries where only a few are handled at one station. The wood barrell holds distilled water.

a 117-cell "tank" battery. Charging methods are not exacting so long as the rate does not exceed that which causes the battery to gas rapidly or does not generate an internal temperature as high as 115 deg. F.

The modified constant potential method (bus about 3 volts per cell) allows rapid charging. Under this system, a fixed resistance is left in the circuit to the individual battery and the bus voltage is kept constant. The correct resistance is that which, at the finishing rate, will drop the bus voltage to 2.6 volts per cell. Ampere-hour meters can be used to stop charging at a certain point and step the charge to a lower value toward the end. Automatic controls are available which will cut off the power at a definite time after rapid gassing begins.

Gravity Influences Capacity

The ampere-hour efficiency of lead batteries can be 85 to 90 percent. The voltage efficiency will be about 80 and the watt-hour efficiency around 75 percent. Specific gravity of the sulphuric-acid solution, depending on battery design, will be around 1,280 at full charge. The maximum ever used, 1,300, gives the greatest capacity but shorter battery life than the lower gravities. Because of the need for maximum capacity per unit of space, mining batteries are never operated at 1,200 gravity, full charge, which might be practicable for duties in other industries.

A lead battery is permanently damaged if left idle without full or practically full charge. It hastens the formation of a white skin of lead sulphate on the plates. Alkaline batteries can stand discharged without internal damage. On standing, however, it is just as important to keep the level of the electrolyte above the plates as when in use. It is best that the battery be completely discharged if it is to be idle for weeks or months. Normal gravity of the solution is 1,200 and it does not vary materially with state of charge. This solution is caustic potash and water; strength about 20 percent.

Initial voltage of an alkaline cell is 1.45 at the normal discharge rate. The average voltage is about 1.2 and the final 1. Charging is best done by either the constant potential or the modified constant potential method and the tapering current should begin at about 50 percent above normal rate. It requires at the finish 1.85 volts per cell or about 2 volts per cell at the bus. For instance, an 80-cell 96-volt 281-amp.-hr. 27.04-kw.-hr. battery for a shuttle car would require a charging generator that delivers at least 160 volts. The battery can be charged at any rate which will not cause the internal temperature to exceed 115 deg. F. Temperatures above that will shorten battery life.

Maintenance men should be specially instructed never to add acid to an alkaline battery. That admonition is hardly necessary at the larger mines, but at the smaller mines such a thing has happened and promptly ruined the battery.

Once a month the top connectors should be checked for tightness. Heating is evidence of looseness or a dirty contact and can be detected by feeling the connectors with the hands after passage of a fairly heavy charge or discharge current for a few minutes.

Gravity of the solution of the alkaline battery, as previously noted, does not change during the cycle of use. The state of charge is indicated by an ampere-hour meter which, having been set at zero at full charge, shows the ampere-hours taken out. The correct amount of charge is 25 percent more ampere-hours than was discharged. Overcharging should not be necessary if a battery gets regular daily use, but if, in a period of a week or two, it is idle or used but a shift or so, then it should be completely discharged, followed by a charge and overcharge.

Spare Batteries Necessary

With batteries of either the lead or alkaline types, it is necessary to have a spare battery for each unit multiple-shifted. Where service is severe, a charge will not last an entire shift and so some boosting must be done or the unit exchanged for a charged battery at the lunch period.

Lifting the battery with a chain hoist and trolley on a swinging or stationary I-beam is satisfactory for shuttle cars where height is available or easy to prepare. If but two or three shuttle cars are served from a charging station, the racks for batteries on charge can consist simply of wooden cribs or benches served from the monorail. One scheme for serving a greater number consists of two rotating tables on each side of the car runway. This way the battery is moved a minimum distance with the hoist and by turning the table any battery is quickly positioned for loading onto any car. Roller-type transfer rocks also accomplish substantially the same objectives.

As locomotive batteries are many times heavier than shuttle-car batteries, changing by hoist is impractical. Consequently, various schemes of rolling the battery off onto elevated tracks are used. A common method with power tanks and heavy battery locomotives is to run the unit into a pit or stall where side rails automatically elevate the battery so that when the holding dogs, pins or bolts are disengaged the chassis can be pulled out from under.

Where two or more batteries requiring 130 to 140 volts each at the bus are charged at one station and 275 to 280 volts d.c. is the available power, a balancer set may be used to advantage. This consists of two commutator machines connected to the same shaft, their armatures in series and the shunt field of one connected in parallel with the armature of the other. Part of the battery-charging load is connected between the neutral and positive and the other part between the neutral and negative. The machine capacities need be no larger than the difference in loads on the two sides. During charge the batteries are live to ground, a disadvantage with any system of charging direct from a trolley.

Records Help Get Results

Records should be kept of dates or times when batteries are watered. With ampere-hour meters available, the state of discharge at the end of the shift and the charging rate also should be recorded. Maximum cell temperature is another guide toward an operating and charging practice which will result in maximum life. With the lead battery, gravities at the beginning and end of each shift indicate the state of charge and general condition of the battery, especially when balanced against ampere-hour readings. Once a week or once in two weeks the lead battery should be given a long overcharge at a low current and these overcharges should be made a matter of record.

There is a precaution against loss of acid from a lead cell if one particular cell is selected as the pilot for daily gravity readings. After each use a small quantity of acid stays in the hydrometer syringe and if it is set aside in normal vertical position, the acid runs out each time. In a year the acid in the pilot cell may be weakened until it has less capacity than the others. Adding a small measured quantity of 1,300 acid at the end of a charge and overcharge is the remedy.

TIRES AND WHEELS

Proper Haulage Operation Cuts Tire Wear—Filling or Banding Available for Reconditioning—Hand Welding Now to the Fore—Filling on Locomotive Possible—Cast-Iron Car Wheels Also Welded in Larger Numbers

BRAKE-SHOE applications, normal straight track friction and differential slippage around curves slowly wear the treads and flanges of wheels and tires on locomotives. Spinning wheels at starting or on a heavy pull plus excessive use of sand multiples speed of wear many fold. Any changes in equipment design or operation which will slow down tire wear are even better than reducing cost of tire replacement by a new maintenance method.

It may pay to reduce cars per trip. Offsetting the reduction in tons per trip is a gain in speed and, perhaps, safer operation. The many economic advantages of grading to cut off humps and to fill swags are generally recognized. It has been aptly said that sand is too cheap. If the price were raised to 10c. per pound, many mines would be forced to make grade improvements resulting in long-time savings even with higher sand prices. Dispatching to prevent stopping trips on grades or curves is a help. Locomotives with a series operating position on the controller benefit by the addition of drive chains between axles. Dynamic braking control for main-line locomotives operating on long stiff grades saves both brake shoes and tire wear. Recent locomotives with stub axles and individual motors on each side are largely free of differential tread wear on curves.

Assuming a standard through-axle locomotive operating in a well-laid out, effectively graded and efficiently managed mine, high tonnage means big mileage (some main-line locomotives do 150 to 200 miles per day) with proportionately heavy tire wear. Three years ago, before conservation of materials became so important, a *Coal Age* survey indicated that about 50 percent of the mine-locomotive-hauled coal tonnage of this country was being moved on filled tires. Some of operators not welding tires at that time now have adopted the practice and many others are investigating the possibility or are saving their worn tires with welding in mind.

"No saving" and "unsafe tires" were the principal arguments against the filling of tires. A few large coal producers had gone exclusively to rolled-steel wheels, which cost but little more than tires and often are specified with extra thick treads that will stand repeated turnings and then permit handing the wheels down to use on locomotives of the next smaller wheel diameter. While the treads on these rolled-steel wheels have been successfully filled, the majority of operators are interested in tire repair —that is, in learning the most efficient ways of welding tires.

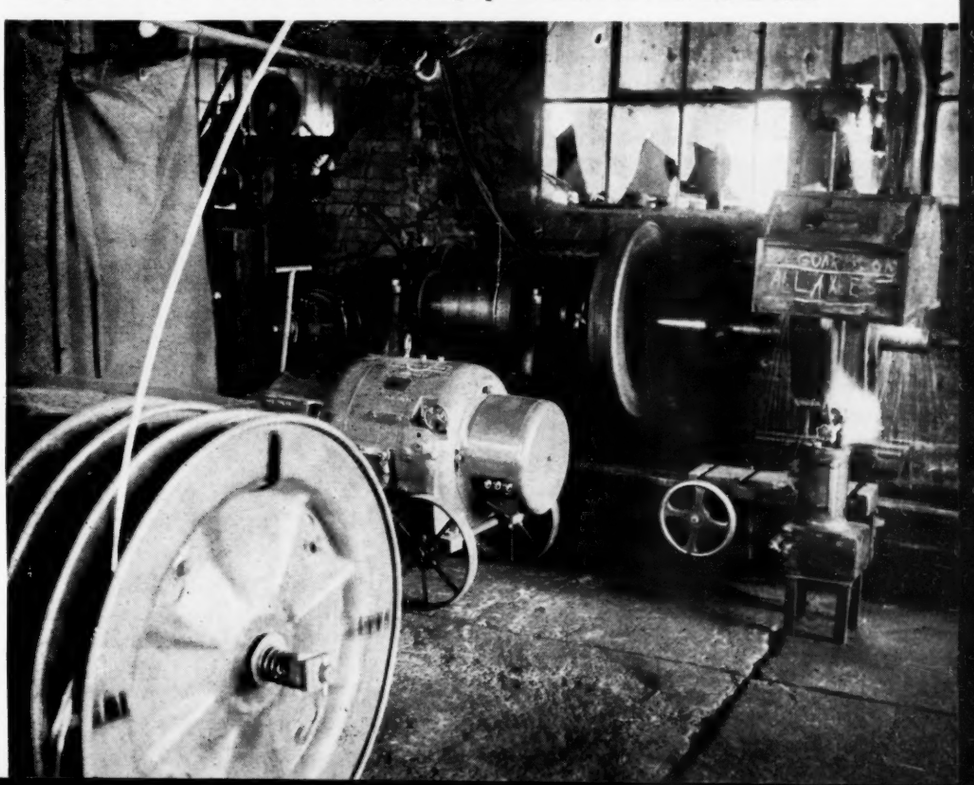
Arc-welding with steel electrode is recognized as the best means of doing this filling. It can be accomplished by automatic machine or by hand. With the latter a number of variations in technique are possible. Principal questions are size and quality of electrode, advisability of turning in a lathe and whether to fill with electrode entirely or weld in a filler band of tire-quality steel.

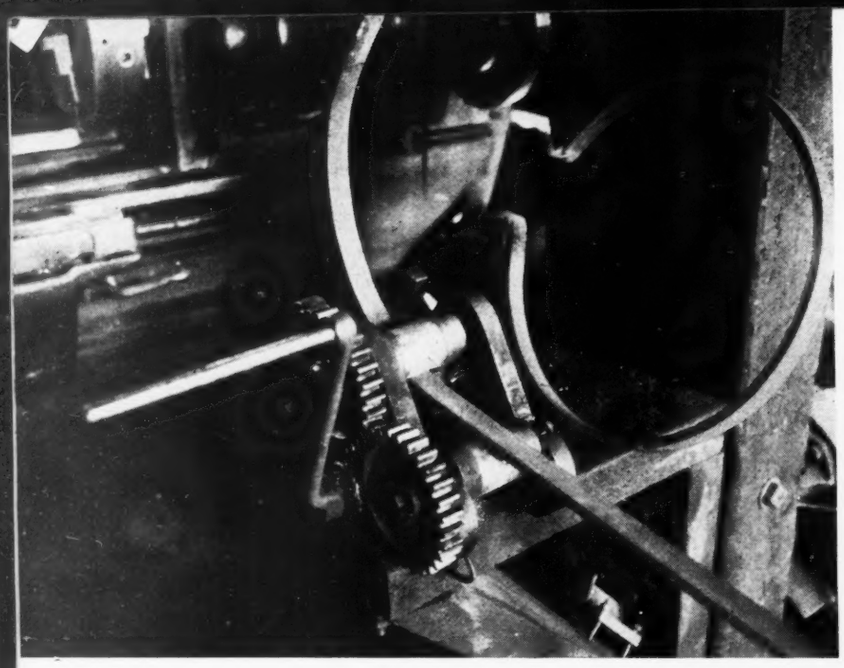
Three or more commercial shops and about a dozen central shops operated by large coal producers are equipped with automatic welding heads for filling tires. Preheating to 300 to 400 deg. F. with an oil torch before beginning welding is the general practice and some find it advisable to blanket or case the welded tire in asbestos or rock wool for annealing by slow cooling. At other shops automatic peening hammers strike the weld bead while it is hot. With automatic welding, however, this peening and annealing against breakage is not the general practice. Pre-war costs of automatic welding in tire repair were in the range of $5 to $11 per tire. Turning tread and flange to the proper contour is an added cost.

Mention has been made of new tires breaking in service. Such breakage has been attributed principally to improper fit—that is, tires too tight. A Pennsylvania company pioneering in arc-welding tires found that by care in specifying and getting tires bored to proper diameter, no breakage occured when they were welded. That discovery was made many years ago when welding was done by hand. The company later installed an automatic welding machine. Shrinkage should not exceed the old rule of 1/80 in. per foot of wheel diameter.

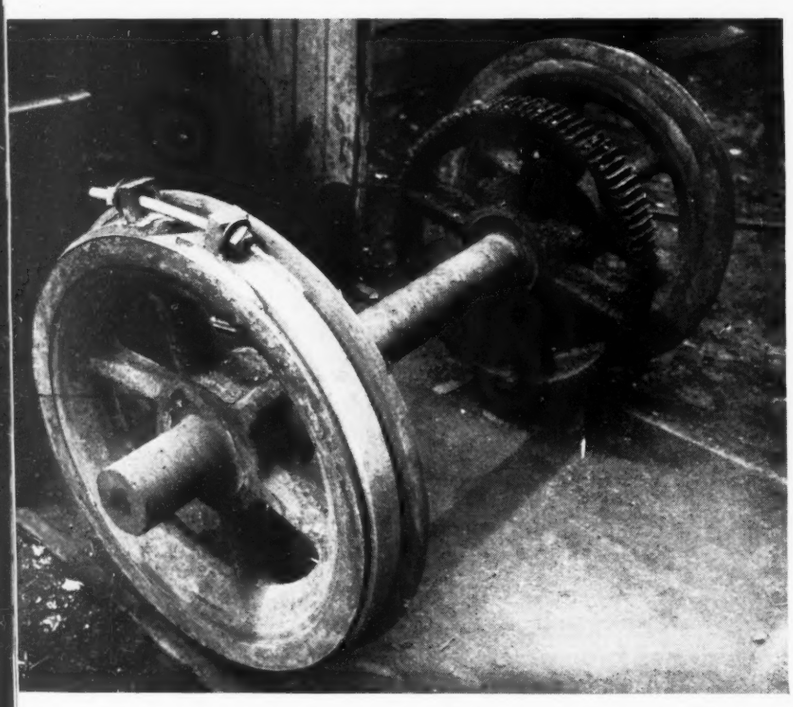
Fortunately, practically all reported instances of breakage of welded tires

In this coal-company central shop, where tires have been welded for 21 years, preheating with a torch is continued during welding by automatic head installed in 1930.



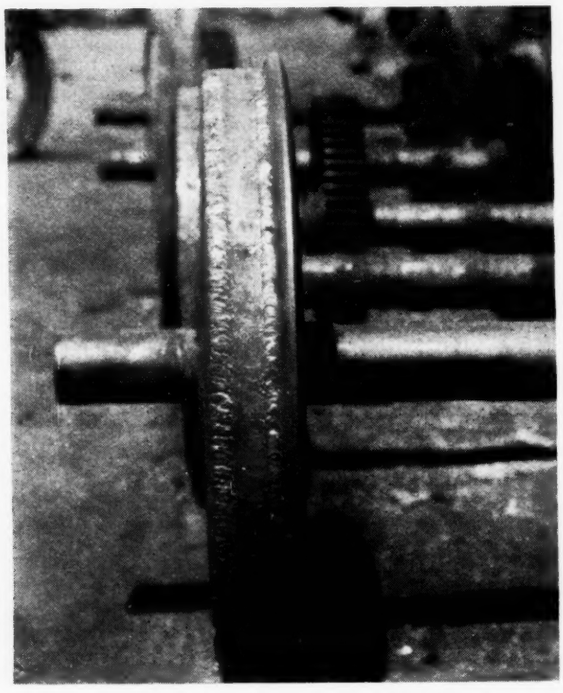


Bending filling bands of tire-quality steel.



Bolt-and-lug method of tightening band in machined groove.

C-clamp holds band in machined groove for welding.



Completed weld on a band-filled tire.

This manual welding by angled bead, using ¼-in. coated electrode costs, including finishing in a lathe, 50 percent of the price of a new tire. Life in this particular case is 9 to 10 months, compared to 11 to 11½ months with a new tire.

Recovering cast-iron car wheels by welding up flat spots.

happened soon after welding and before they went into service. Users report the comforting observation that unless the welded tire has a flaw in manufacture, a rarity nowadays, the peening and rolling action in normal service rapidly lessens the chance of breakage. Taking general practice as the criterion for judging the safety of tire welding and remembering that only a few accidents due conclusively to some particular practice soon brings widespread condemnation, it appears that welded tires can be considered practically as safe as turned tires.

Since an automatic welding machine is hardly procurable at present, hand-welding methods are the focus of attention. Judging from years of application and widespread use, three general methods are giving satisfaction: (1) welding a band of steel into the tread groove and finishing in a lathe, (2) filling entirely by electrode and finishing in a lathe, (3) filling entirely by electrode and using a gage band without finishing in a lathe.

The filler-band method has not been widely adopted because many have tried it without knowing all the "tricks" necessary for a satisfactory job. Some companies that have mastered the art have welded tires by the filler-band method for many years and report worth-while operating results and savings.

Preventing Loose Bands

Loosening of the filler band when worn thin was a major difficulty. To prevent this it is necessary: (1) to turn the tire-tread groove to a flat smooth seat for the band; (2) bend the band to uniform curvature in a roller-type bender; (3) apply the band under tension while heated; and (4) weld the band with a small electrode (not over $\frac{3}{16}$-in.) by a bead on each side continuously around the tire preliminary to filling the spaces left on each side of the band.

Two proved ways of putting tension on the band are: (1) Weld lugs with holes in them to the ends of the band and then tighten by a clamping bolt. After the band is tacked in place, remove the bolt and cut off the lugs with a gas torch. (2) Form the circular band with ends turned up and slightly backward so they can be pulled together with a C-clamp. After the band is tacked in place, heat the ends with the gas torch, trim them if necessary and hammer them down into place.

Banded tires coming into the shop for a second rebuilding are best prepared by routing out the remnant of the worn band in a lathe and at the same time cutting to flat surfaces the welded portions of the original groove. Bands of 0.40 to 0.50 carbon steel are used and the stock ranges in thickness from $\frac{3}{8}$ to $\frac{1}{2}$ in.; width, $1\frac{1}{4}$ to 2 in. For the final welding layer, the usual practice is $\frac{1}{4}$-in. 0.40-carbon electrodes.

In the second general and most widely used method—filling entirely with electrode and finishing in a lathe—several variations in technique have been employed. Most companies using small electrodes (not over $\frac{1}{4}$-in.) do not anneal after welding but many take the precaution of welding sections but a few inches long alternately on diametrically opposite sides of the tire to prevent excessive heating.

Introduction of higher-capacity motor-generator welders a few years ago made it possible to use larger electrodes (up to $\frac{3}{8}$-in.), thus reducing the labor cost of manual welding. With a large electrode and filling the entire groove in one thick layer, progressing continuously without alternating from one side to the other, annealing is necessary immediately after welding. The tire may break if it is allowed to air cool before such annealing.

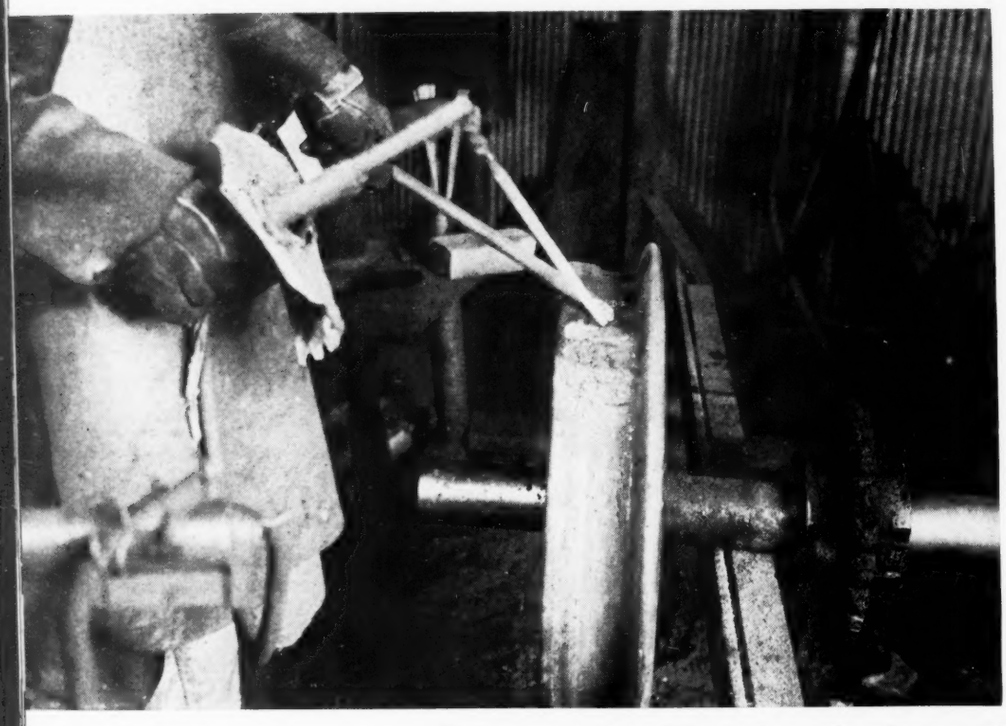
A variation of the large-electrode practice consists of feeding into the arc an auxiliary filler rod—say $\frac{3}{4}$-in. in diameter 0.80 to 0.90 carbon. This further cuts welding time and imparts hardness to the surface. Reversed polarity (negative to the electrode) is used in this dual rod welding. With

Tread and flange built up by automatic welding and ready for lathe finishing.

electrodes as large as $\frac{3}{8}$ in. the welding operator has a more fatiguing job because of the increased heat and weight of electrode holder and connecting cable. A handle or holder with water circulating through it and suspended by a 15- to 20-ft. cord or wire, including a long coil spring, solves those difficulties.

Manual welding of tires without filler bands, preheating, annealing, lathe work before or after welding and, in some cases, without removing the trucks from the locomotive (inside-frame type) is widely practiced in southern West Virginia and eastern Kentucky. While its popularity is

At the right is an automatic peening hammer following the hot bead.



With reversed polarity, filling is done with a ⅜-in. coated electrode and a ¾-in. auxiliary filler rod, 0.80 to 0.90 carbon.

largely confined to the small railroad shipping mines, some large producers also use it. Low cost, no spare tires required and shortening the time a locomotive must be out of service are the advantages. The disadvantage is a rough tread for the first few shifts.

A large percentage of this on-the-locomotive tire filling in the areas mentioned is done by contractors who truck in their own welding equipments, usually consisting of resistance welders hooked to the 275-volt d.c. trolley. Much of this work is done over week-ends and during off-shifts when the locomotive normally is idle and there is plenty of d.c. power available.

Procedure is to first "tack" around in the center of the worn groove a gage strip, $\frac{3}{8}$x$\frac{3}{8}$ in., $\frac{1}{2}$x$\frac{1}{2}$ in. or other size, depending on the depth of wear. The top of this strip serves as a guide for filling and thus is an aid toward getting a smoother and more nearly concentric job. Round bars $\frac{3}{8}$ to $\frac{1}{2}$ in. in diameter sometimes are used in place of square stock.

After a layer 6 to 8 in. long has been applied the welding is stopped and the deposited metal, while still hot, is hammered vigorously with a short-handled hammer weighing 4 to 6 lb. This serves to condense the weld metal, relieve strains and smooth the surface. With a skillful welder applying the top layer as level as possible, followed by hammering, the result is a reasonably smooth surface. Welding cost ranges from 50 to 75 percent of the price of a new tire. To this saving can be added the cost of changing tires or trucks.

With all of the tire-welding methods in use, hardness of surface is the much debated question. Some coal-mining companies have tried and discarded tire welding because service tests indicated to them that the treads were so soft they wore nearly twice as fast as new tires. Other companies have been happy with softer treads because they gave greater traction. Manufacturers of welding rods can now supply them to provide almost any hardness desired but if smoothing in a lathe is done the hardness is limited to that practical for the tools used and lathe capacity. The hardness factor is a reminder of the advantage of banding, where steel of tire quality is welded into the tread and the wear is sure to be practically the same as on a new tire.

More Car Wheels Welded

With the growing scarcity of materials, coal operators also are giving more attention to repair of cast-iron mine-car wheels by welding. Normally, such welding is done to fill flat spots, which otherwise would necessitate scrapping the entire wheel. The usual practice is to build up the worn spots with a carbon-steel electrode and then grind as necessary to bring the tread back to the true circle and slope required. One anthracite company which adopted this practice many years ago found that worn spots could be built up about three times, after which the character of the surface was such that the electrode would not adhere during grinding and subsequent use.

PUMPS AND FANS

Careful Installation and Regular Attention Desirable With Pumps—Lubrication and Packing Critical Factors—Good Installation and Regular Inspection Cut Pipe and Valve Maintenance—Regular Checks Keep Fans Tiptop

PUMPS AND FANS are built to give service with a minimum of trouble provided they are properly installed, operated correctly and given the attention to inspection and lubrication any mining equipment normally should have. Piping offers a maintenance problem in itself and also influences maintenance of pumps, valves and accessories.

Low maintenance can be built into pumps, pipe and fans, and it often is a paying step to make the extra investment necessary to achieve this goal. In pumps, for example, bronze and special alloys should be specified where there is any possibility of acid water or other corrosive elements. Special linings, such as porcelain, rubber, cement, etc., may be employed. Substantially the same arguments apply in the case of pipe, valves and fittings.

When water can become so acid as to eat out ordinary steel in 24 hours, which is actual experience at several operations, the value of cast-iron, copper-bearing, cement-lined, asbestos, rubber and fiber pipe becomes readily apparent. If there is any possibility that such conditions can exist, even though the severity is at a minimum, resort to special pumps, fittings and pipes should be seriously considered. In these days, also, wood and tile take on added importance in mine damage, and in many applications can show substantial savings, in addition to being easier to get. Abrasive material is another factor in pumping and drainage, and many of the steps taken to combat corrosion also help in handling gritty material.

Low pump maintenance starts with installation. Pumps should be set on a solid foundation and leveled up in all directions. This applies with equal force to small gathering units, although the foundation may not be so pretentious. At any rate, they should be firmly anchored. Pipes should line up naturally. Forcing to effect alignment should not be permitted. Neither should the pump be used to support the pipe; independent support should be the invariable rule. All auxiliary piping, especially with the larger units (stuffing-box seals, drain connections) should be in place and in working condition.

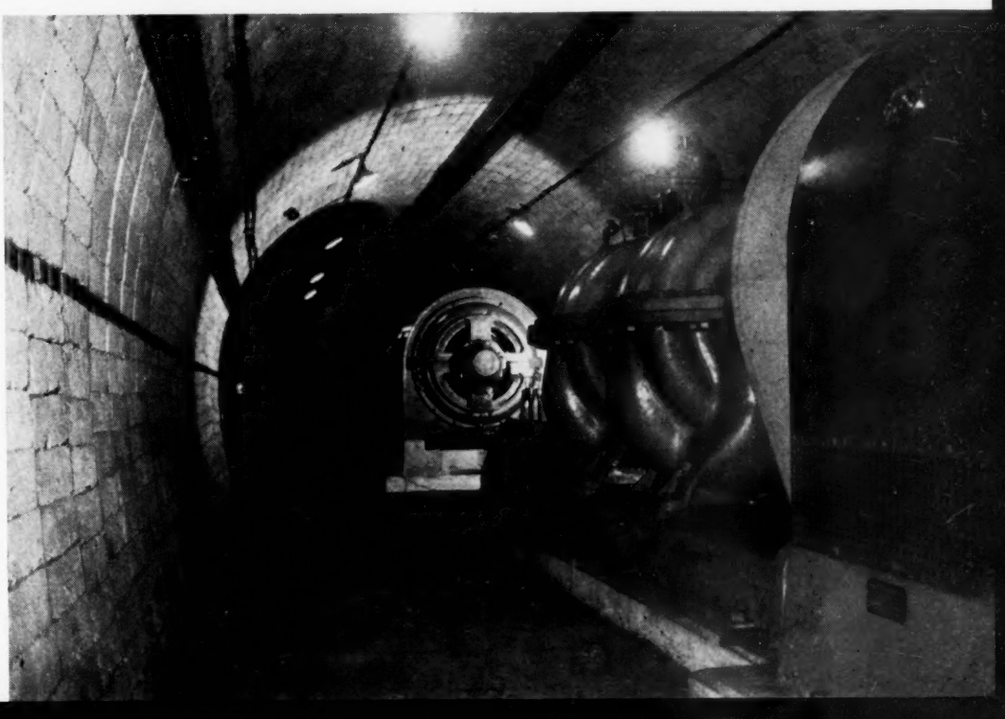
Most coal-mine pumps operate on electric power, with steam as the second most popular driving medium. Maintenance therefore includes attention to motors and controls, discussed beginning on p. 105. Careful lubrication in accordance with accepted practices, of course, is necessary (p. 75), and regular inspection pays here as well as elsewhere. In the case of small gathering pumps, rebuilding them for V-belt drive instead of gears has been found a most helpful maintenance step by many operators, who also are specifying such drives on new units.

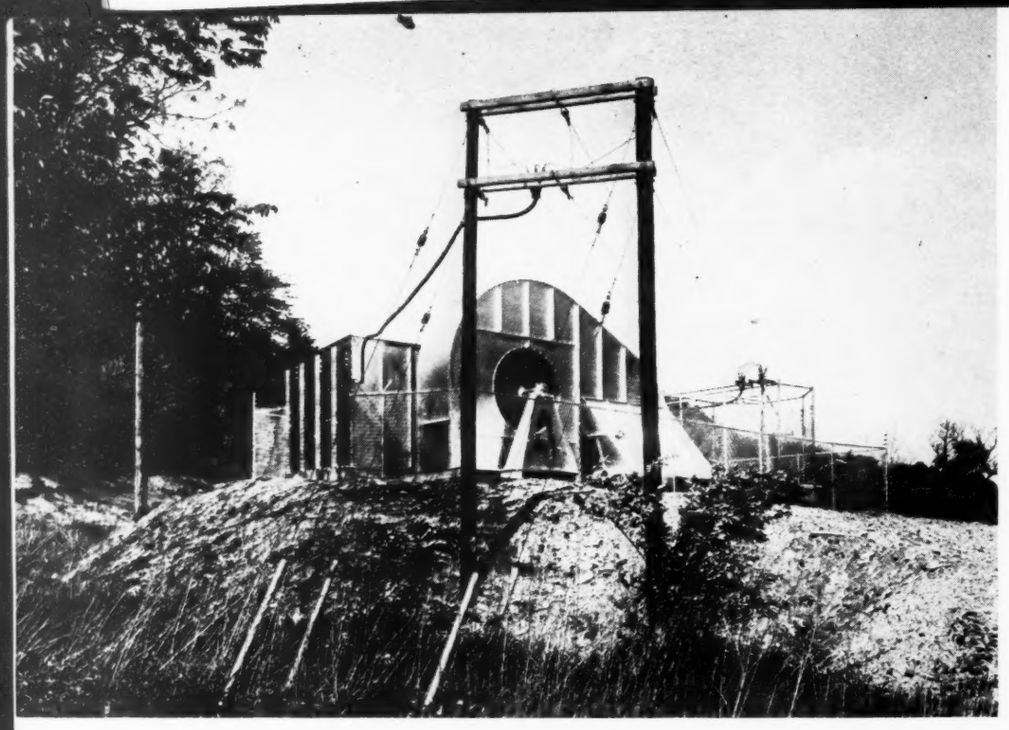
Rebuilding worn casings, impellers, etc., by welding is a growing practice in coal mining and large savings are reported by many operators. A relatively new step is metallizing to reclaim worn or scored shafts, although in normal service such conditions should never occur. Investigation of these and other maintenance steps are well worth the time of any coal company using much pumping equipment.

Many things can interfere with the proper functioning of pumping equipment which have little effect as far as wear or damage to the pump itself is concerned. Consequently, they will not be treated here. However, certain things can vitally affect pump condition. One is lack of water. A centrifugal pump, especially, should never be started dry. Proper priming is essential. A strainer is essential on the suction line, which should not be too long and should be without high spots or air pockets. Too much of a suction lift is a distinct detriment in pump operation and may result in damage. Foot valves should not be used in suction pipes unless absolutely necessary and then should have an area at least 50 percent larger than the pipe. And it is always desirable to have the suction pipe larger than the discharge, which also should be as large as possible for a variety of reasons.

The packing and stuffing boxes, particularly on high-lift pumps, should be given careful attention. Packing should not be allowed to dry out, and as a precaution against this a small quantity of water should drip from the stuffing boxes at all times. When repacking stuffing boxes all old packing should be removed and the new should be of the proper type, thickness, etc. The water seal ring should be checked to see that it is not plugged with scale or old packing. Glands must not be drawn up too tight, as shaft scoring is the inevitable result.

Regular attention keeps pumps in the low-maintenance ranks.





Little—but regular—attention preserves trouble-free fan operation.

Pumps handling dirty, corrosive or gritty liquids under suction lift generally are provided with a supply of clean non-corrosive liquid to prevent rapid scoring and corrosion of the shaft sleeves, and steps should be taken to make sure that this supply is not interrupted. Otherwise, special sealing or greasing provisions are necessary in most cases.

Overloading pump motors is not unknown; it arises from excessive speed, excessive discharge (operation under less than rated head), too-tight stuffing-box packing, binding of rotating elements, worn bearings, bent shaft, misalignment of pump and motor, etc. These, along with cavitation (suction lift too high), also result in noise. Operating centrifugal pumps at low capacity or against a low discharge results in heating and eventually may vaporize the water, if continued long enough, with the possibility of seizing of the parts. To avoid this, a bypass line and valve may be installed from the pump discharge back to the suction line. Pumps should never be throttled on the suction side.

Many of the points previously discussed also apply to reciprocating pumps, although with this type a foot valve should be installed in the suction if the lift is 15 ft. or more. Air chambers should be installed in the suction line and also in the discharge if any disturbance resulting from pump pulsation is detrimental or results in water hammer or other hydraulic shocks. Valves, packing, etc., should be kept in good condition. Excessive use of elbows, tees, etc., is a major cause of objectionable noise or water hammer in the suction line. Loose crossheads, pins, crankpins and main bearings result in pounding. Too much speed, operating at excess pressure, plungers packed too tight, poorly fitted moving parts, bearings too tight and gears not properly assembled result in overloading of the pump motor.

The valve gear should be lubricated every 12 hours with a medium-grade oil. The crossheads and levers on duplex pumps at the ball-and-socket joint should be flushed with heavy oil twice in every 12 hours of continuous service. Piston rods and valve rods should be flushed three or four times daily with a heavy cylinder oil where they pass through the packing.

Close attention to packing quality and methods is necessary in the cases of both stuffing boxes and pump pistons. Pump valves should be inspected regularly to see if they are in good condition. Metal valves should be ground once a year, or oftener, if found to be worn. It also is recommended that valve springs be changed once a year. Plenty of room, good light and other good conditions are necessary in pumping installations to facilitate inspection and dismantling in case repairs should be necessary.

A number of things insure a low-cost long-lived pipe job. One of the major ones is good alignment, which relieves couplings and valves of strain. As a corollary, pipe should be well supported all along or at least every 10 ft. or so. Valves should never be used in place of such supports. Reaming protects valves. Pipe dope should be kept out of the line, and blowing out new lines in advance may save damage to valves, pumps, etc. The right gaskets are important. Lubricating the bolt threads on bolted joints makes it easier to draw them tight, and also facilitates taking the joint apart when necessary, in addition to protecting the threads against rust and corrosion. If quick-opening valves are employed, lines should be protected against water hammer, perhaps by a tee and short length of pipe with a cap. Painting the outside as a protection against rust and corrosion is very worth while, or special coatings may be employed.

Valves should be inspected often, with special attention to telltale spots on the cover at the bonnet joints. The interior should be checked for grime, dirt, or other foreign particles, as well as worn or galled spots. If such are found, the valve should be reseated, reground or rewashered at once. Gate valves should be placed so they can be opened fully and should never be used for throttling, which normally results in erosion or wire-drawing. Valves should be installed in protected places. Screw threads on the rising-stem or outside-yoke-and-stem types should be protected by rubber hose or a similar covering.

Lubrication Heads Fan Care

Fan installations at mines comprise the fan itself and the necessary motors and controls. The latter, of course, should be maintained much the same as any other electrical equipment (p. 105). As to the fan itself regular lubrication naturally is essential. And, of course, the prudent operator protects it against the elements and also against anything being thrown into the blades.

One manufacturer suggests that, in general, the fans be checked perhaps once a month to see if any parts are wearing. Fans naturally are painted when installed, and any parts showing corrosion should be cleaned and repainted at once. The regular monthly examination should include the bearings, and the drives should be examined frequently to see if there is any wear or the belts are loose. If the drive is of the gear type, the lubrication should be carefully checked.

Fans should be stopped occasionally and the wheels examined for cracks in the blades. Shaft alignment should be checked with both level and line. Also, connections between the fan and the mine opening should be examined carefully for air leaks. Very often as much power is used in moving leaking air through settings as is used in ventilating the mine.

ELECTRIC MOTORS

Dirt, Faulty Lubrication and Vibration Are Major Insulation Enemies—Brush Holders, Brushes and Commutators Need Careful Attention—New Heat-Resisting Coils Help —Winding an Art Requiring Skill and Knowledge

EFFICIENT maintenance of the wide variety of electric motors used in the coal industry calls for broad experience and training in the electrical field and a goodly share of mechanical ability. Numerous so-called electrical failures are caused by mechanical failures; therefore the mechanical and electrical factors must be closely coordinated to accomplish the most in preventing breakdowns. When a repair does become necessary, it should be done the best way possible because the job cost itself often is equalled or topped by the cost of the shutdown or expense of dismantling, transporting to and from the shop and reassembling the unit.

To faults of engineering and installation can be traced many failures, but it does not follow that a bad condition must be suffered indefinitely. Motors which prove not large enough for a particular duty should be (1) replaced by a larger motors, (2) rebuilt with insulation standing more heat or (3) fitted with forced ventilation. Faulty space provisions for inspection and cleaning should be rectified if at all possible. It may mean cutting a handhole or manhole in a part of the machine or structure, or the rebuilding of a case or guard. Water, dirt and corrosive vapors should be combated by covers or partitions and bringing clean air to the motor for ventilation.

Many of the good practices in maintenance are common to both a.c. and d.c. motors. Of these, cleanliness comes first. Dust may be combustible; it forms a blanket which resists dissipation of heat and it closes ducts, thus restricting ventilation. It is an accumulator for stray lubricant and may contain abrasives affecting bearings and wearing surfaces, such as commutators, or conducting particles of metal, carbon or graphite which will cause a leak or flashover. Finally, it may hide defects whose detection would have prevented trouble.

Cleaning with an air jet, 20- to 40-lb. pressure, is an effective means in most cases, but judgment is necessary to prevent blowing the dust back into places where it cannot be dislodged. Use of 90- to 120-lb. air is condemned because it may tear insulation. Wiping with a dry cloth, use of long brushes, and wiping with cloths moistened with petroleum solvents or carbon tetrachloride are other means. In some special cases dipping of a small motor or part in the cleaning solution may be permissible, but soaking is likely to be detrimental.

Leaking or misapplied oil or grease has been the cause of a large percentage of motor failures. It causes deterioration of coil and connection insulation on both a.c. and d.c. motors and damages mica V-rings and bar insulation of commutators. With modern motors with ball, roller or sealed-sleeve bearings, leaks are likely only through gross negligence in applying lubricant. Correct methods are outlined in the lubrication article (p. 75).

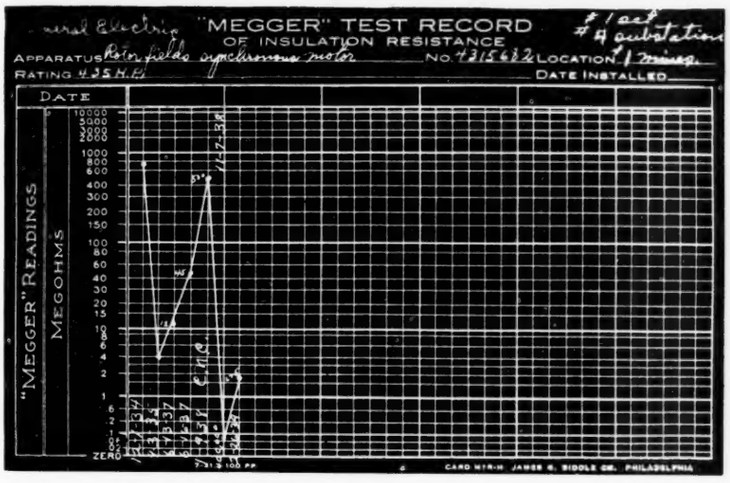
Principally because of lubrication difficulties, "armature down on the pole pieces" used to be a leading cause of mine locomotive failures. Now, practically all the old units have been changed to ball or roller bearings. Such changeovers on old stationary motors are just now getting well under way. At least two manufacturers are furnishing new heads complete with bearings or are furnishing hubs and bearings which are installed by cutting the center out of the old head and bolting the new cartridge to it. One large bituminous company with mines in several states is changing all of its old stationary motors to ball-bearing.

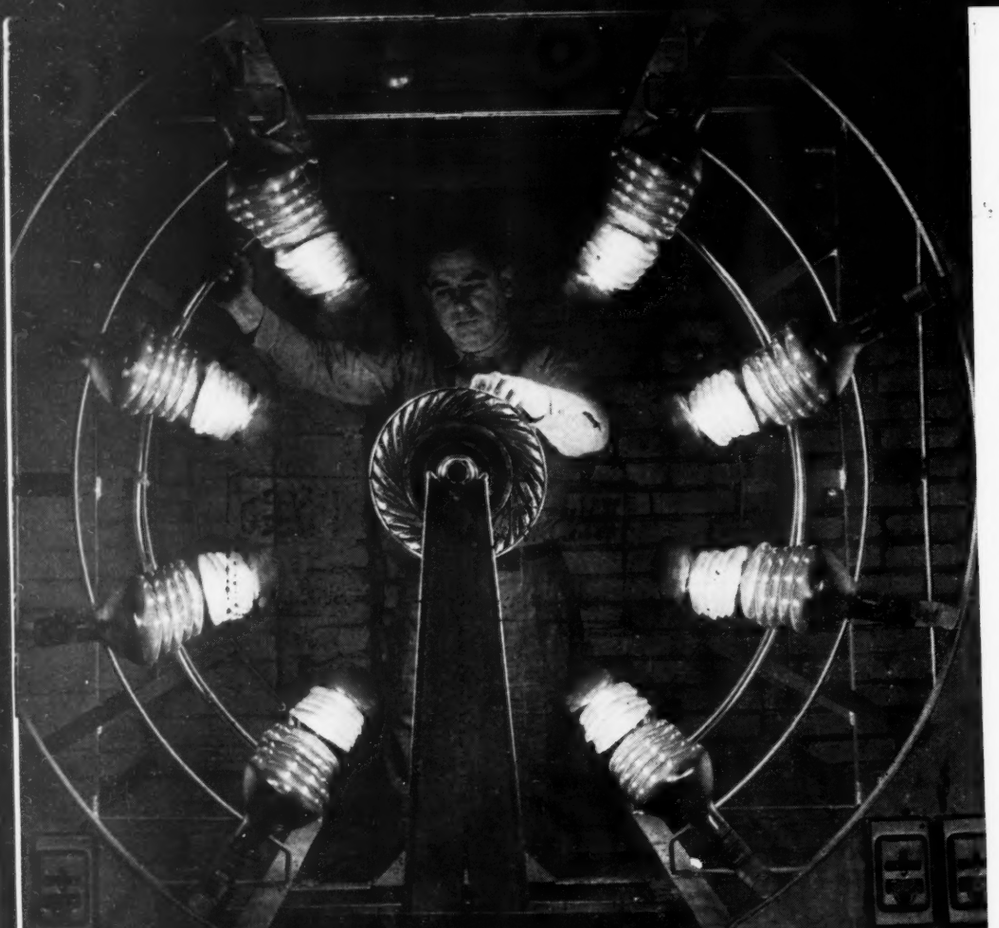
Today, cements and varnishes are available which are highly resistant to oils. Coils that have been exposed to oil should be carefully cleaned with solvent, thoroughly dried and then painted. Leads that come out near the bottom of the frame or where oil exposure is likely also should be coated with the oil-resistant paint.

Motors should be inspected for vibration, as vibration stands with heat and dirt among the enemies of electrical insulation. If the fault is not found in the foundation, loose bolts or alignment, then the armature or rotor should be balanced. Usually a static balance on smooth level ways is sufficient, but if the armature is long and operates at high speed, balancing in a dynamic machine may be necessary.

If coils have become loose due to heat and vibration, dipping or painting with varnish to fill up the crevices and tighten the coils may add many years to the life of the winding. Semi-annual or annual inspection should include a check of air-gap uniformity. This is done with a long feeler gage,

Value of insulation tests depends upon comparison with previous tests.





Replacing steam heating with these infra-red lamps cut the time for baking a 12-in. armature from 18 to 5 hours.

assuming that it is an open-type motor or that inspection holes are provided. Lifting on the shaft is a less certain way of detecting bearing wear. Anti-friction bearings on a.c. motors greatly lessen the difficulties of maintaining the air gap, which usually is less than on d.c. equipment to insure efficient operation and provide other desirable characteristics.

On large motors, especially those operating on 2,300 volts or higher, semi-annual insulation-resistance tests can serve as a warning of impending trouble. These tests are preferably made with a megger but can be made with a voltmeter if 500 volts d.c. is available. The real value of such tests is realized in comparing successive tests to determine if there is any marked deviation from the average.

Brush holders, brushes and commutators are responsible for the higher maintenance of d.c. motors compared to the simple squirrel-cage type of a.c. induction motor. Once-a-week inspection is recommended for the brushes of most d.c. motors but the period should be adjusted to suit the duty and experience with that particular type of motor.

Commutators should not be lubricated but instead the proper quality of brush found for the duty. Regular inspection of brushes should include: (1) observation of length of brush remaining, (2) seeing that brush moves freely in the holder, (3) checking tightness of brush shunt connections, (4) noting if any springs are broken or badly weakened and (5) seeing that none of the holders has worked loose and changed position.

When looking for hidden causes of trouble such as sparking, rapid brush wear or rough commutator, alignment of the holder stud and brushes with respect to the bars should be checked; also spacing of the brushes and the setting of the brushes with respect to the neutral position. For most motors, spring tension should result in approximately 2½ lb. per square inch of brush contact, but the range is wide due to brush quality and motor design. Checking with a small spring scale will eliminate a lot of brush trouble. To prevent commutator damage, new brushes always should be seated by cutting them to proper curvature. This is done by pulling back and forth under the brush a piece of sandpaper using care to hold the smooth side of the paper tightly down against the commutator surface so that the corners of the brushes will not be rounded. If lack of space or reluctance to shut down the equipment forbid, a brush can be cut to curvature by feeding a stick of special abrasive against the commutator just ahead of the brush.

Even commutators that appear to be operating satisfactorily should be cleaned to reduce friction, but not with an abrasive unless they are rough. Heavy canvas is recommended for this cleaning. It removes grease and dirt without destroying the desirable finish. Such cleaning can be done safely with the motor operating under load if the pad of multiple-thickness canvas is mounted on a stick of wood several feet long.

Stoning Superior Method

Hand stoning is superior to sandpapering as a means of smoothing rough commutators which are not eccentric. Sandpaper fastened to a curved wooden block does tolerably well, but the flexibility allows it, to some extent, to ride over rather than cut the high spots. Eccentricity, including flat spots, seldom can be corrected without turning with a lathe tool or stoning with a rigidly supported stone.

All but certain high-speed light-duty armatures should have the mica undercut between bars, but usually this is a shop job done in connection with truing a commutator in a lathe. A power saw should be used as a rule and on the larger armatures the saw should be supported rigidly rather than held by hand, as would be done on a field job. The hand methods of slotting by three-cornered file, hacksaw blade or special blade fastened to a handle can be satisfactory but take time and skill. It is highly important on any job to eliminate feather edges of mica that might be left. Besides causing the brushes to jump, this mica, when broken off, may embed in the brush faces, thus increasing contact resistance.

When armatures are in the shop for repairs or when a motor is being given a periodic general inspection and overhaul, commutator bars should be inspected for looseness. This is done by tapping them lightly with a small hammer. A drummy instead of a solid sound indicates that the clamping ring should be tightened.

In the winding shop most of the problems are common to both a.c. and d.c. motors. The loads handled by many mining motors—those on loco-

motives, for instance—are too severe for long life of cotton insulation. Heat scorches it, bringing about shrinkage and disintegration. The fibers in asbestos and glass insulation do not char and therefore withstand much higher temperatures, but the limit is reached when the heat destroys the varnish binder and filler.

Glass-insulated armature coils have proved their worth at many properties and the best results have been achieved where the standard of maintenance already was high. They are not a cure-all, however, especially for sloppy operation and maintenance of the equipment. One company which has gone over to glass coils 100 percent reduced the total annual armature burnouts of 173 motors of all types from about 60 in 1929 to 9 in the year 1941.

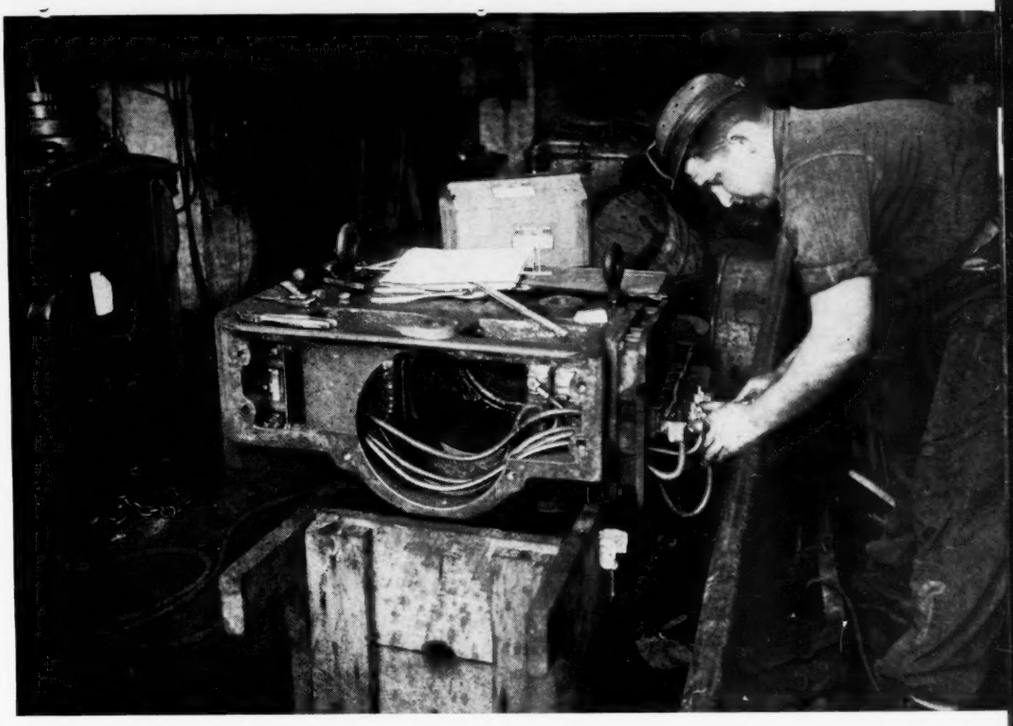
Best Winding Essential

The best is none too good in armature winding and the best requires high skill and dependability on the part of the workman plus proper equipment. For that reason it is likely to be unwise for a coal company to do its own winding unless the job justifies full time for two or three men. The shop should include a safe and convenient dipping tank and a drying oven with accurate temperature control. Infra-red lamps which emit penetrating radiations and were adopted by the automobile industry to dry body paint have been applied successfully to armature baking. In an old steam-heated oven, 18 hours was required to bake a 12-in. armature. The time was shortened to 5 hours by replacing steam heat with 120 250-watt infra-red lamps in reflectors.

Applying new bands to a rewound or repaired armature requires skillful workmanship and takes considerable time. Too often the bands over the coil ends are not tight enough or, in the case of the wider bands, one end is loose and the other tight. With machine banding at least two sets of temporary bands should be put over the coil ends (consecutively) to bring them down to a solid position before the final bands are put on. The lathe or banding machine should have a variable-speed drive which maintains tension on the wire when rotation of the armature is stopped. Instead of a fiber clamp to secure wire tension by friction, thus depending on uniformity of wire diameter, tension should be obtained by threading the wire around a number of sheaves or by feeding it off a drum with a friction brake. The anchorage guy should include a spring scale to indicate pounds tension on the banding wire.

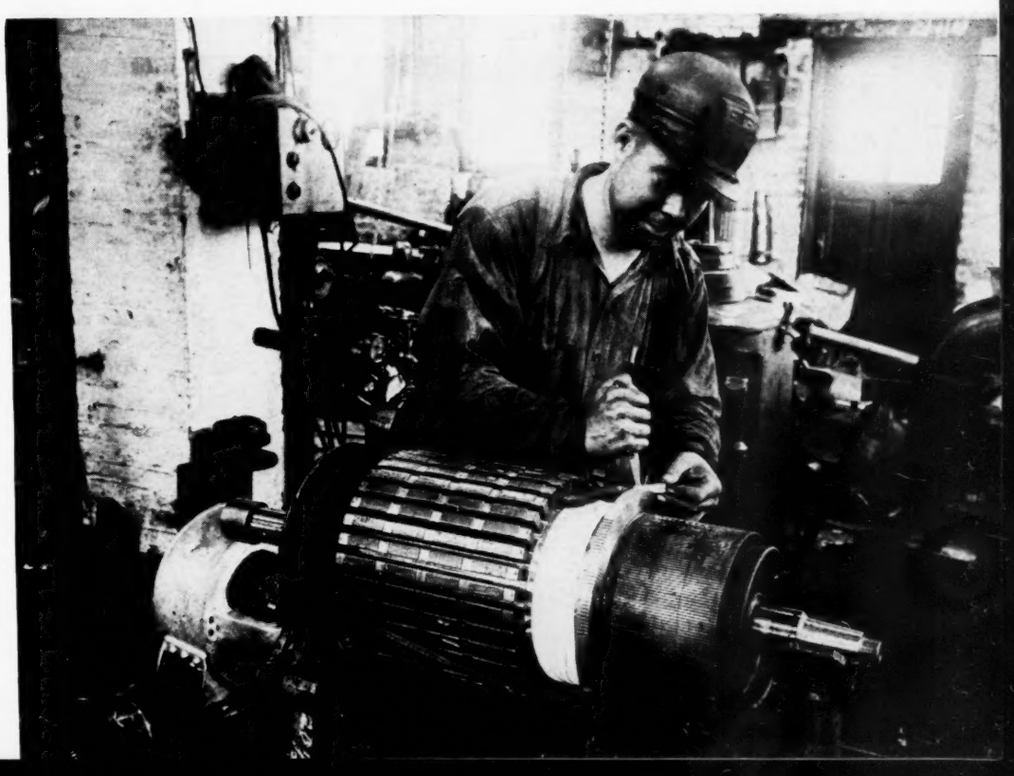
Curiously enough, the sheave-and-weight method, which requires no lathe or bending machine and is about as old as armature winding, still is unexcelled for keeping uniform tension on the wire, bringing the coils down gently but firmly to position and finishing with bands of uniform tightness.

Handling rewound, repaired or new armatures should be done with the utmost care. Lifting should be done with a band or sling around the lamination and the armatures should be supported in storage or transit by the shaft rather than rested on the lamination. A slight bump against the commutator, coils or lamination may ruin the winding. Commutators on armatures in storage should be covered with paper to keep the surface clean and minimize chemical change or oxidation.



Installing asbestos-insulated leads in a mining-machine motor.

Everything must be done right in rewinding to avoid armature burnout.



CONTROLS AND BREAKERS

Old Units Require Special Attention in Both Maintenance and Parts Supply—Frequent Checking and Attention Necessary With All Types—Proper Type and Care of Resistances Important—Moisture Elimination Vital

MAINTENANCE of the controls in circuits and on electrical machines is only slightly less important than maintenance of the machines themselves. The only difference is that in a few mining duties the control can be shunted out as a temporary expedient. In the past, many control parts were not easy to get and now the difficulties are multiplied. Prolonging life of a control part by preventive maintenance, besides saving cost, scarce materials and installation labor, relieves the purchasing department of the detail and correspondence which sometimes reaches formidable proportions when ordering a part for an old controller or breaker.

Controllers and breakers run into so many types that it is especially important to give all the information possible in ordering parts. All different repair-part catalogs available should be carefully preserved and the correct name and part number taken from these catalogs. Complete nameplates and serial numbers should be given. On very old breakers and controllers, time may be saved by sending a pencil sketch with a few dimensions of the part. Furthermore, needs for parts for these oldsters should be anticipated as far ahead as possible. If the parts must be made up specially, deliveries may be very slow.

In spite of the urge to keep it running, if old equipment is unsuited to the duty or is in a generally unreliable condition and way out of date it may be far better for all concerned if the authorities can be persuaded to allow replacement with a new unit that will be comparatively free of trouble. Keeping a good stock of fingers, tips, springs, shunts, blow-out coils and so on for controllers for underground mobile machinery is seldom neglected. The trouble comes with such items as certain stationary controllers where there are only a few of that type in use or the duty is light so that parts are not needed frequently. Items like coils, however, which cannot be repaired and which take a long time to get, should be stocked. When received, it is especially important to label these infrequently used items with secure tags showing in detail for what duty the part was ordered.

While the controls on mining machinery are largely of the magnetic type, there remain numerous manually operated controllers such as on the shortwall machines, older locomotives and some of the slip-ring motor-starters in tipples and preparation plants. Usually these manual controls are subjected to severe duty and require frequent inspection, cleaning and attention to fingers, tips, springs and so on. Arcing more severe than normal at the fingers of d.c. controllers calls for attention to the condition and connections of the blow-out coil.

Brass or copper dust from abrasion of the contacts should be cleaned out to prevent it from starting shorts or grounds. An arc-burned finger or segment should be dressed with a file until there is no tendency to catch. Judicious use of a grease, such as vaseline, may greatly prolong the life of fingers and segments in many duties. Daily application is not too often on some types of mine locomotives. For many of the older machines, improved fingerboard replacements are available and no time should be wasted in buying and installing them.

Annual Cleaning Helps

Once a year or oftener, insulating blocks, reverse drums and the like on manual controllers should be cleaned with extra thoroughness and painted with a red-oxide varnish. The same treatment is good for all insulating surfaces in controllers and breakers in general.

Tightening nuts and screws on connections and terminals at regular intervals should be the rule on all controls and breakers. Those subjected to severe vibration need attention quite often. Even without vibration, time may result in loosening through the cumulative effects of expansion and contraction.

On the two general types of contactors, a.c. and d.c., many items common to both take the same maintenance. Copper contacts need dressing only when they get badly oxidized or when arcing has left some high spots. This dressing should be done with a file, not with a stone, sandpaper or emery cloth, and need not be carried to such a point that the contacts are real smooth. The usual operating roughness does no harm. They can be used until nearly burned away.

Repeated difficulty, even with contacts kept in good shape, calls for checking the pressure with a spring

Weekly inspection and repair work keeps the flameproof controller on a 6-ton 250-volt locomotive in good shape.

balance and adjusting to the manufacturer's recommendation. A weak spring may cause burning contacts, and a spring too stiff may cause the contactor to chatter or drop out with slight dips in voltage.

Silver contacts, which are better conductors than copper but are not suited to frequent and high-duty operation, usually consist of facings on copper and so should not be dressed down. Although silver oxidizes, heat at the contact reduces the oxide back to silver. Thus, the contacts are self-cleaning.

Generally speaking, no lubricant should be used on contacts or on the working parts of contactors, as it would collect dirt to cause gumming and perhaps electrical leakage or arcing. Graphite, used sparingly, may help shafts, but it should be remembered that graphite is a conductor.

Sealing surfaces on the magnet and armature should be kept clean and parts kept in shape and alignment so that the faces meet "on the level." Shunts require frequent inspection, especially in a corrosive atmosphere. On a reconditioning job, steel parts should be painted and coils revarnished.

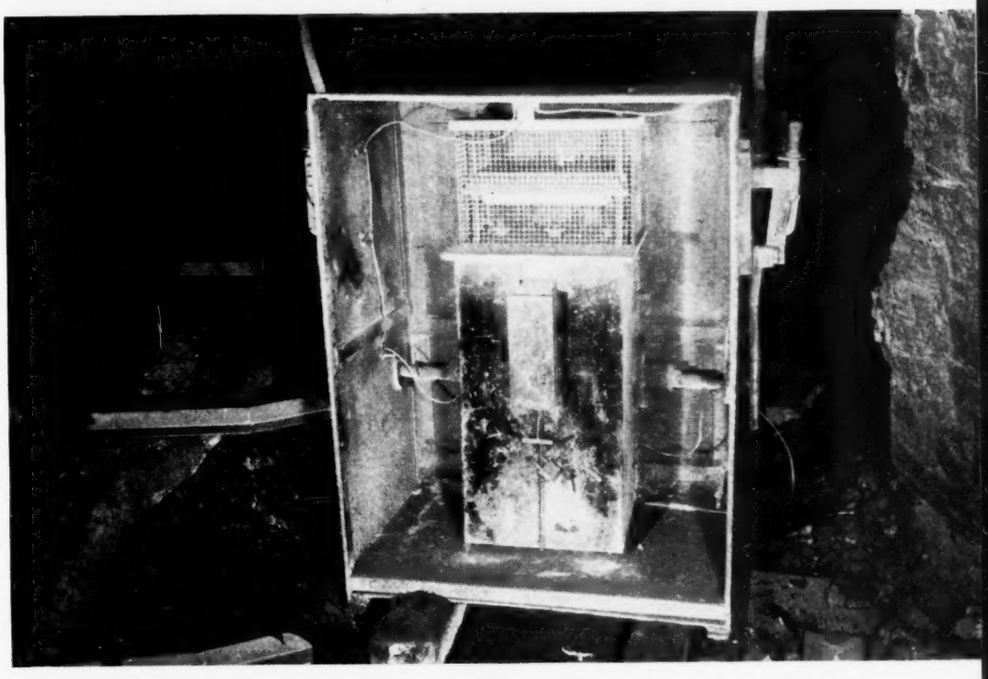
Coils Handle Variations

Arc shields on d.c. contactors should be renewed when they are burned to the point where a few more weeks of service might make them ineffective. Coils for most d.c. contactors are designed for a voltage range of 80 to 110 percent normal. At voltage dips much below the 80 percent, they won't pick up and at voltages much over the 110 percent, heat may destroy them. It should be remembered that heating with d.c. increases as the square of the voltage. Some controls for d.c. underground equipment have contacts designed to close on as little as half voltage and to not drop out unless a dip goes lower than one-fifth normal.

On a.c. contactors the coils usually are designed for a voltage range of 85 to 110 percent. With them, also, the heating goes up still faster than the square of the voltage. The a.c. type also heats above normal if the armature has failed to close to the magnet. Humming, a frequent difficulty with a.c. contactors, can be caused by a broken shading coil, low voltage, spring pressure too high and improper sealing. The function of a shading coil is to produce a circulating current out of phase with the main current and thus provide a slight polyphase effect.

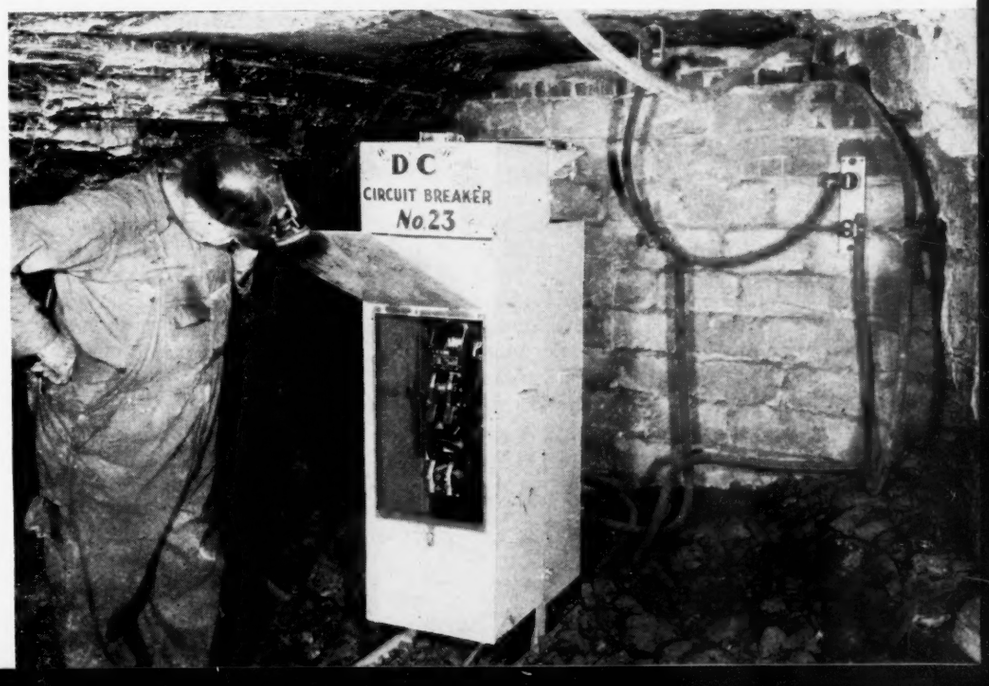
Use of oil of the right viscosity is

Spot-welding terminal bolts on a continuous-strip locomotive resistor.



Automatic reclosing breaker in a steel box with skids on the back lessens chance of damage when moving to a new section.

Proper installation, frequent inspection and a padlocked box help.



necessary in relay dashpots. In fact, only the type furnished should be employed and the dashpots should not be overfilled. Oil too thin permits rapid action and oil too thick may slow the movement beyond use. Plunger and cylinder must be kept smooth, clean and free of gum. Temperature-overload relays should be mounted where the air temperature is very close to that surrounding the motor to be protected. Bending the thermal element should never be done. Follow instructions or examine carefully for other means of adjustment if a comprehensive test such as putting the element in hot water or oil shows adjustment is necessary.

On all contactor controllers and breakers (automatic reclosing type), efficient maintenance depends a great deal on a thorough understanding of the unit. If the connections are complicated, diagrams and instructions should be preserved in the covers or kept handy.

Control resistances of the newer continuous-strip or punched-plate type require little attention compared to cast-grid units. On stationary work, where numerous cast-grid resistances still are used, there is the problem of keeping the grid-connection faces clean and tight. Periodic tightening of the bolts usually will prevent heating and damage. Bad joints must be dismantled and cleaned or brazed together with a gas torch. In some cases brazing has been done between all grid joints, as on a.c. hoist-motor controls.

Leads to a resistance that gets hot should not be renewed with ordinary wire or cable but with asbestos-insulated wire developed for that purpose. On any resistor it is necessary to tighten the terminals every so often because the heat causes rapid oxidation of the copper, resulting in tendency toward loosening the grip.

Oil-circuit breakers obviously must have the oil kept above the minimum level and if the duty is frequent or severe the oil must be changed every year or so. Conversion of manual-type breakers to magnetic operation reduces maintenance by eliminating the possibility of improper operation and arcing.

Where d.c. automatic circuit breakers are used in substations and underground on mine circuits, those in the latter duty should have locked cases to prevent unauthorized tampering with adjustments. In ordinary duty these breakers should be inspected once a month to see if arcing tips and horns are adequate. Once every six months, all nuts, bolts and screws should be checked for tightness.

If a breaker or other complicated item of control is located where condensation of moisture is severe or if it is used very little—for instance, on a pump held in reserve for extra wet seasons or emergencies—a lamp or other source of heat should be installed to keep it dry.

WIRE ROPE AND CABLE

A Little Care Pays Big Dividends—Lubrication Offers Greatest Possibilities—Kinking Should Be Avoided—Large Sheaves Desirable—Attachments Should Be Carefully Made—Good Rollers Essential in Slope Operation

GREAT conservation possibilities exist in the consumption of wire rope in the coal industry. While many companies have perfected the maintenance of their large and expensive ropes to a point where little improvement seems possible, plenty of large ropes still are crying for improved working conditions and numerous medium to small ropes are being liquidated every day in what should have been the prime of life. Just a little more care in handling and lubrication and in maintaining drums, sheaves and rollers can boost rope life to several times that possible in the usual rough-and-tumble service. Some problems peculiar to shovel and dragline service are discussed in the article starting on p. 123.

Manufacturers have always preached, and rightly, that a wire rope is a machine and deserving of the same consideration. Firstly, all ropes in both stationary and running duties must be used as designed and must be protected from corrosion. Running ropes have bearing surfaces that must be lubricated. Added to those, if long life is to be secured, the ropes must not be subjected to numerous indignities such as kinking, sharp bending around an angular post and plain jerking.

Lubrication offers the greatest possibility for improvement. In the following actual example the lessons are plain. On a coal hoist with self-dumping cages in a two-compartment shaft, one of the 1¼-in. ropes broke before there was a single broken wire showing on the outside. The break was not near the cage attachment but at a point resting in the head sheave when the hoist was started. At the time of the break the rope was well smeared with a tacky compound and all indications pointed to no neglect in lubricating the rope. But an examination of the broken rope showed the inside without any lubricant, badly rusted, the hemp cord pulverized and many wires on the inside worn or corroded almost in two.

It may have been that the rope was subjected to weather, a leaky roof or corrosive fumes while in storage as a spare. Perhaps the compound was too heavy to penetrate properly, inasmuch as heating of neither the compound nor the rope was resorted to when the applications were made. Furthermore, the old compound, perhaps much of it dry, hard and containing some abrasive, was not cleaned off before more was applied.

There also was an error in the original planning or installation. The fleet angle was 3 deg. 12 min. instead of within the 2-deg. maximum limit that some rope manufacturers recommend. Later ropes of the same construction and properly lubricated gave reasonably good service, however.

A lubricant obviously must be light enough to work all through the rope at normal operating temperatures or, if heavier, it must be heated enough on application to penetrate. A difficulty is that lubricant of a light consistency will drip off or be thrown off the rope at the turns, no longer affording proper lubrication in the drum

and sheave grooves and not giving proper protection from water.

In general, the lubricant should be a stiff tacky compound which, if heated to about 212 deg., will penetrate the stranding. Theoretically, heating the rope as well as the compound would be ideal, but such a practice, in many cases, might result in overheating sufficient to damage a hemp center or, if something went wrong, to affect even the steel. For thorough lubrication it is recommended that the rope be pulled slowly through a box of hot compound. There should be a wiper at the top or one end to remove most of the old compound on the surface and the arrangement can include wire brushes, which help to open spaces between the strands and wires.

There are many applications of large and medium ropes where the heated-compound application is impractical. One solution is first to lubricate the rope thoroughly by the drip method with a thin oil. Then after enough service to drain off the excess, apply compound cold by a hand brush or drip methods. Lubricating a rope which is wet on the inside is wasting time and lubricant and may even do damage by confining the water inside. Drying the rope is a problem that must be handled in accordance with circumstances and the time available. A dried rope should get the thin-oil treatment first.

Kinking Is Bad

Kinking by the formation of loops during uncoiling and installing medium and smaller ropes—say ¾-in. and under—is a very common cause of breaks before the remainder of the rope has shown any wear. Whenever a man in the coal industry is caught allowing a kink in a wire rope, he should be reminded that it is equivalent to allowing a Jap to twist his tail. The rope should be stretched out by rolling the coil along the ground or mounting the reel.

It goes almost without saying that the larger the drums and sheaves the better. Rope manufacturers recommend minimum limits. Sizes double or triple those minimums usually will pay if the design of the machine permits. Assuming that a sheave is too small and design rules out a larger one, then using a rope with a finer stranding may result in greatly increased life. However, the stranding must not be too fine for outside impacts, such as whipping against rock in slusher loading. In many uses like the one just mentioned, an effort should be made to locate sheaves so that the rope is not given a reverse bend; that is, by two sheaves close together.

Changed grooving to reduce fleet angle on this shovel drum greatly increased the life of the hoist counterweight ropes.

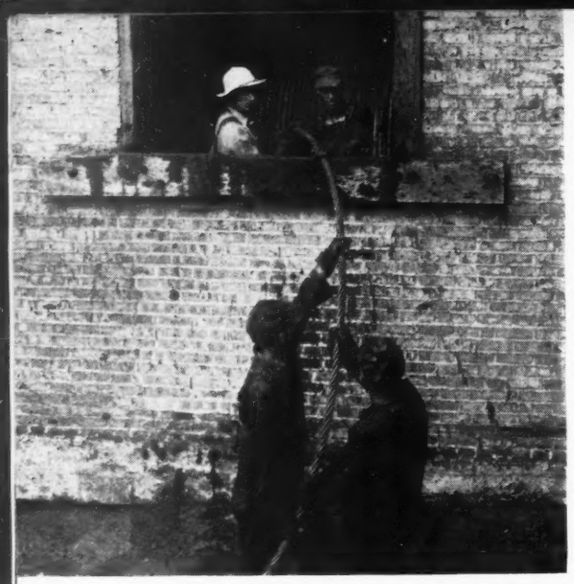
Corrugations worn in the bottoms of grooves on drums and sheaves are damaging to a rope. Therefore, turning or relining to restore them to smooth condition is important in maintenance. New ropes in larger diameters should not be installed without checking the grooves in drums and sheaves to see that they are sufficiently wide. Wedging of the rope in a groove is bad.

Cutting off the ends of ropes and/or changing ends of whole ropes to move points of stress to new places can add considerable life in many duties. Two points on a shaft hoisting rope which may suffer extra stress are at the cage or skip attachment and the section on the head sheave at the start of a hoisting cycle. If the main drum carries enough extra rope, or is equipped with an auxiliary take-up drum, then two to four times during the rope life 15 to 20 ft. should be cut off at the cage and a new attachment made.

Large thimbles and clamps rather than socketing constitute the preferred attachment for duties such as hoisting. Less skill and care are required to insure a safe job, inspection is surer and vibration stresses are not so likely to concentrate at one point. Socketing still is the preferred method for certain duties, especially if light weight and space limitations are factors. Principal points in doing a good socketing job are: (1) Each individual wire and also the inside of the socket must be cleaned thoroughly and dipped in weak muriatic acid; (2) wires must be fanned out uniformly in the socket; (3) the socket must be preheated to about 120 deg., and (4) pure zinc must be used.

Pouring zinc in a rope socket.

Comparisons of rope life mean more when made between successive ropes on a certain hoist or job than on ropes of supposedly similar duties at two different mines. Usually the duties will be enough different to affect rope life materially. Furthermore, the standards of inspection to determine safe



Care is being exercised to avoid bending this 1½-in. rope as it is passed into the hoist house for installation.

limit of life may be different. At shaft mines, 400,000 tons per rope on a car hoist may be a good record and will compare with 1,000,000 tons on a skip hoist where lower speed is a considerable factor. Similarly 400,000 cu.yd. per rope may be good on one strip shovel and 800,000 on another.

What degree of deterioration, as revealed by inspection, should warrant taking ropes out of service depends on too many local factors to be settled here. Hoisting of men on the same cage as coal may call for rope renewals before inspection reveals any damage or wear. If a rope removed from a man and material hoist can be utilized without much waste on a severe but less critical duty, such as on a slope or plane underground, then it may be good practice to replace the rope on the man and material hoist every six months or a year even though no sign of weakness is apparent nor reasonable to expect.

In addition to the usual method of looking for broken wires, calipering the diameter of a rope can reveal a crushed core and bad internal condition even though no broken wires have shown up on the outside.

On slopes and incline duty, especially on monitor planes, poor maintenance of rollers is likely to be the principal cause of short rope life. At humps or turns the pressure of the moving rope against the roller may be high. Anti-friction bearings should be used and if the angle of rope deflection is not great a relatively small and lightweight roller should be used so that the inertia will be small and the roller can start quickly when the speeding rope comes down on or slaps over against it. Pounding of a rope on a plane when brakes are applied rather suddenly, causing the rope to rise high above the track and whip back down, should be corrected if at all possible. The answers are more care on the part of the operator, regrading the track or applying a mogentor for maintaining uniform speed and effecting dynamic braking. Application of electric control usually improves rope life.

Head sheaves with grooves maintained smooth and non-pinching are necessary for long rope life.

Track Cables Well Made

Track cables on aerial trams handling coal and refuse suffer from wear by bucket wheels, the effects of the elements, including burning gob piles, and vibration and flexing at saddles and terminals. With cables of the locked coil construction, lubrication by drip from a tank on the bucket trolley is effective in keeping out water. Aerial-tram manufacturers have perfected their design to the point where cable trouble is rare. In rebuilding a cableway or moving because of changed conditions, soliciting the manufacturer's advice may save much grief with ropes.

Fineness of the stranding of wire ropes has already been mentioned. Other design features—regular or Lang lay, right or left lay, round strand or flattened strand, hemp or wire core, preformed or not preformed—have their advocates and special applications. Only rope specialists are capable of making recommendations for special jobs. In most cases the use of plain 6x19 or 6x37 right regular-lay rope for running jobs will serve the purpose if the maintenance, in all its angles, is given close attention.

Split shaft-lubricating box with wedges to hold the halves together. The bottom is a piece of conveyor belting to scrape the dirt and old lubricant off the rope.

WELDING AND FACING

Welding Applicable to Practically Anything Around the Mine—Gas and Arc Processes Both Have Their Fields—Hard-Surfacing Yields Wide Benefits—Metallizing Now Moving Into New Rebuilding Fields at Coal Operations

WHEN means became available for joining metals and adding to them without resorting to the blacksmith's forge and anvil, manufacturing and maintenance of machinery was revolutionized. Practically every worn or broken item of mining equipment can be restored to normal. Extremely hard materials can be bonded to the surface of new or old parts to increase life many times.

While the arc-welder holds first place in quantity of work to which it is adapted, the oxyacteylene apparatus is an indispensable tool because of its value in cutting and its many uses as a source of concentrated but lower heat. Metal spraying or metallizing, the newest "builder upper," has a wide field in the application of thin coatings of metal to replace wear or for protecting steel from corrosion. Thermit welding, extensively used in joining rails and repairing shafts and frames of heavy machinery, is temporarily out of the mining picture because the preparation requires aluminum powder, a war-restricted product.

While numerous welding jobs can be done satisfactorily with either the gas torch or arc-welder, there are jobs which fall entirely to one or the other. A strip-mining company reports that both are used in repairing the teeth of caterpillar spur gears. After building up by arc-welding, the surface is smoothed by washing with the gas torch.

Both equipments are necessary at coal mines using power machinery. Cutting is the exclusive field of the gas torch. Electric arcs with carbon electrodes have been used successfully for cutting steel sheet, as in scrapping old railroad cars, but control difficulties, wide cut and jaggedness rule it out for cutting in maintenance work. Cutting with the gas torch includes removing metal for making a V for arc-welding.

While cast iron can be welded under most conditions by electric arc, brazing with the gas torch is common practice. Brazing of any material is done at a much lower temperature than gas welding with a steel filler rod and therefore is more widely used. For instance, welding rails in a mine with torch and steel rod would require much larger quantities of gas than the brazing which is the recommended practice. Heating rivets with a gas torch is good practice where a forge fire is inconvenient or impractical. Many other small heating jobs, such as occasional bending of small pipes, rods and shapes, are in the field of the torch.

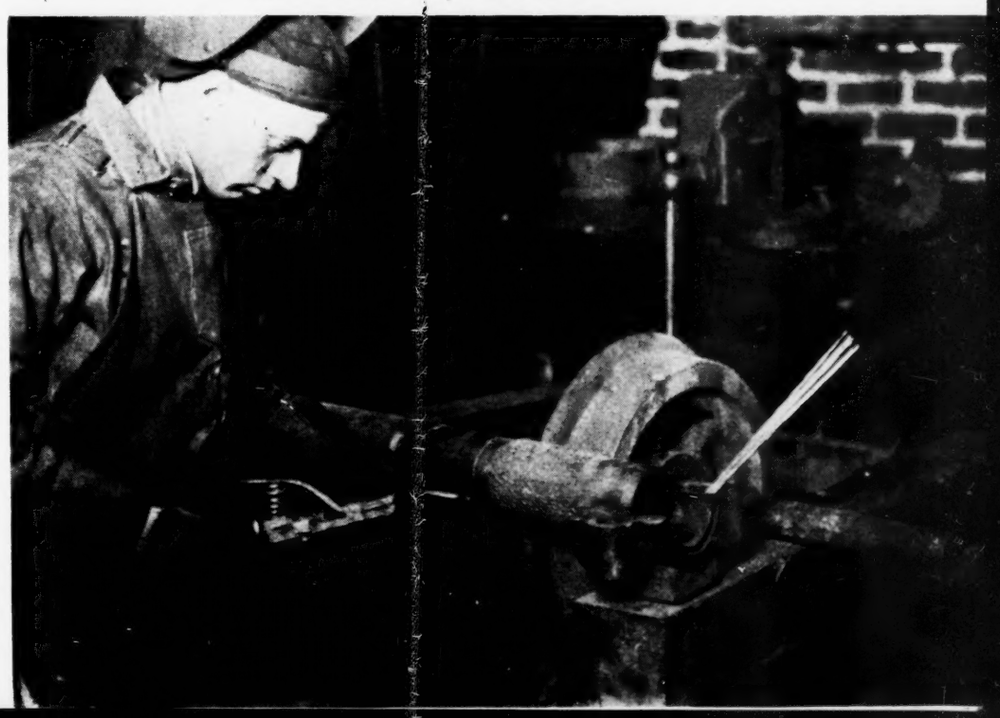
Because of the intense localized heat, arc-welding need not heat the work or base metal to more than 500 to 600 deg. F. at a distance of 2 to 3 in. from the weld. Except in very thick or heavy work, that limit of heat spread is accomplished, however, only by interrupting the welding frequently and allowing the work to cool between times. This localized heating and the fact that welding begins almost immediately when the arc is started, put arc-welding to the front as a mine maintenance tool. Warping of sheets and shapes can be eliminated by the proper technique in electric welding. Also, without over-all preheating followed by very slow final cooling, which, with many shapes, would be necessary with gas welding, strains can be avoided which might cause cracking upon cooling.

While most arc-welding jobs can be done with bare electrodes, it takes a coated electrode to produce the finest work because the coating protects the molten metal from oxidation. Wartime difficulties in obtaining coated and other types of electrodes can be alleviated to some extent by utilizing stocks or scrap pieces of heavy steel wire that may have been intended for or used for guys or tying. Even narrow strips sheared from plates can be used as electrodes in welding such plates and for other soft-steel filling.

On any work, obviously, the largest electrode that will produce a good job should be used. Those $\frac{5}{32}$ in. and $\frac{1}{4}$ in. in diameter are practical for most mine jobs. On sheets of 16 to 22 gage it is necessary to use $\frac{3}{32}$ in. or smaller and on very heavy work $\frac{3}{8}$ in. may be used if a 500- to 600-amp. welding machine is available. The intense heat with a high-ampere arc plus weight of the holder and cable add to the welder's discomfort and fatigue. Holders fitted for water cooling and hung on a long suspension, including a coil spring, have been adopted by mining companies using $\frac{3}{8}$-in. electrodes to fill locomotive tires.

Because of the higher currents normally used with coated electrodes and the need for turning out more work per operator, the old 150-amp. machines are entirely out of date at a mine except for a few special jobs.

Tire and axle rebuilt by arc-welding.



Reclaiming dipper bail on strip shovel by arc-welding.

Tipping cutter bits with hard-surfacing material.

Direct-current welding with a motor-generator set is the preferred method because of better control of the arc but the transformer a.c. welder has a definite place where portability and/or low investment are of first importance. Resistance welders are preferred for most bonding because very light weight is considered an advantage overbalancing the disadvantages of power wastage, poorer weld (unless by an expert) and danger of electric shock.

Peening the hot beads of a weld adds to density and strength, results in a smoother surface and relieves, to a large extent, shrinkage strains. It should be done whenever necessity for better welds indicates its need.

Specific arc-welding applications at mines are too numerous to mention in the space available. A separate article (p. 99) deals with tire welding.

Generally speaking, welding falls into two classes: (1) joining parts for strength and (2) renewing a surface which has been worn away. The two are combined in jobs like cracked strip-mine dippers. There, high strength is required plus resistance to abrasion.

With the right electrode and proper technique to avoid overheating —for instance, overheating on one side of a shaft—almost everything from motor armature shafts to teeth on plain spur gears can be welded. A list would include parts of every item of underground production equipment, strip-mining machinery, underground and strip-mining transportation equipment plus the outside handling and preparation machinery. Manufacturers of welding equipment and electrodes are ready to recommend and furnish a quality of electrode for every job encountered at mines. One company operating a group of bituminous mines reported $100,000 of parts salvaged in one year by welding.

Most of the arc-welding is done with "straight" polarity—i.e., the negative of the generator connected to the electrode and the positive to the work or base metal. Thus the current flows to the work and returns via the electrode and holder. In an arc more heat is generated at the positive than the negative. And, because of heat conductivity and bulk, more heat normally is required to bring the work to fluid temperature than is required to melt the electrode. Obviously, a resistance welder working on a trolley-positive d.c. mine circuit is at a disadvantage if the work is mine track or other equipment which cannot be made the positive. Certain rods or electrodes—for instance, 0.90 high-carbon, stainless and manganese rods—work better with reversed polarity and lower heat; that is, with the electrode positive.

Blowing of the arc to one side by magnetic effect of the current in the work often can be remedied by attaching the conductor cable to the work at some different point so the current approaches the weld from a different direction. Vertical and overhead welding should be avoided if possible because much greater skill is required than for horizontal welding. Holding a short arc is a prime requirement in overhead welding.

Before passing to the general subject of renewing wearing surfaces and, in many cases, applying a skin of material harder than steel, the characteristics of gas welding might be considered because it competes with arc-welding in much of this work. High-grade torches, pressure regulators and gages, plus a full line of tips kept in good condition, are essential to efficient, safe and economical gas welding and cutting. By adjusting valves and regulators for different proportions of acetylene and oxygen the flame can be made oxidizing, neutral or carbonizing, thus affecting the quality of weld. Equally good welding can be done whether the acetylene is generated locally in a portable or stationary outfit or is purchased in cylinders.

Gas Piped to Use Points

Acetylene generators are not considered practical for underground work. With stationary generators on the surface it is necessary to pipe the gas to various points of use so that long hoses are not required. A shop close to the preparation plant, with one acetylene generator serving both through piping extended to all parts of the preparation plant and shop, is an equipment- and time-saving arrangement. Oxygen pipes from a tank-served manifold should parallel the acetylene lines. It pays also to have tipples and preparation plants wired for conducting high-current low-voltage d.c. from a central arc-welder.

A motor-driven gas machine for use in making straight or curved cuts in sheets and slabs of steel for numerous rebuilding jobs is a necessary tool in a mine shop serving a large quantity of equipment. Gas is saved and smooth cuts are made.

Removing rivets and bolts with a cutting torch is a great time saver. The same is true in many other take-apart jobs. Worn or broken pinions and gears can be removed by cutting over the keyway, saving damage to the shaft. Taking up old pipe is another job done speedily with the torch. Cutting rails to fabricate crossovers, guard

rails, frogs and points is practiced by a number of companies.

Applying hard materials to worn surfaces or to new surfaces subjected to severe wear utilizes both the gas torch and arc-welder. As a rule, the gas torch is used to apply thin platings containing tungsten or other carbide particles. Other fillers, such as high-carbon (0.90) steel, chromium alloy steels of mild type (3 to 5 percent alloying material), chromium stainless steels (25 to 30 percent of alloying material) and manganese steel, are applied with the arc in nearly all cases. Use of a 0.90 carbon rod produces a weld deposit of about 0.45 carbon. Certain self-hardening rods are applied in uncoated form with the gas torch.

In welding to manganese steel, such as a shovel dipper, a better bond is obtained by using stainless electrode. On a job where a considerable depth of fill is required—say ½ in. or more—softer and cheaper electrodes are used for the lower layers. For instance, in repairing a hole in a cast-steel pump casing, the hole was filled to ⅛ in. with mild steel. Next a layer of high carbon was applied and finally a layer of self-hardening alloy.

Facing Compounds Applied

Tungsten carbide platings, being the most expensive, are not generally applied to large surfaces, but are used widely for plating or facing mining-machine and auger bits. Parts such as gathering arms on loading machines, crusher teeth, clutches on mining machines and loaders, caterpillar shoes, etc., usually are faced with a self-hardening alloy. Some last as much as five times longer than unsurfaced steel.

Although expensive per pound (in the neighborhood of $5), tungsten carbide can be plated onto mining-machine cutter bits for a material cost as low as 2c. per 100. A very thin facing applied only at the tip is satisfactory. Therefore, over 3,000 bits can be treated with 1 lb. of material. Such application is further discussed under mining-machine maintenance (p. 83).

Metallizing, or spraying molten metal onto a surface, has been adopted recently by a half dozen or more coal companies to restore worn parts to standard and protect surfaces from corrosion. Its principal advantage over welding is the almost negligible amount of heating of the part, thus getting away from all danger of warping. Any metal can be coated or built up with almost any other metal. The exceptions, magnesium and tungsten, are of little importance in mining maintenance. The quoted cost of a metallizing unit last June was about $625, at which time a $1,000 investment would include the sand-blasting equipment necessary for some jobs. The metallizer head is a small unit fed with oxygen, acetylene or propane, compressed air and a continuous wire of the material to be applied. An air turbine drives knurled rolls which feed the wire into a flame, where it is melted. The metal then is blown against the surface to be coated or built up.

The coating is about 10 percent porous; that is, the specific gravity will range from 85 to 95 percent of that of the solid. In a bearing sleeve or on a journal shaft this porosity is said to be an aid to lubrication. Anchorage must be secured by having the surface clean and free of all oil, then roughening by sandblasting with sharp particles of sand or steel grit or by scratching or cutting with a tool. On shafts, one method is to cut threads with round bottoms but rough tops. In some cases, also the tops of the threads are bent over with a rolling or knurling tool.

In addition to corrosion-resisting metals and alloys, steel of any carbon content can be applied. If it must be machined readily, 0.10 to 0.25 is used. A surface that is too hard for machining can be deposited with 1.20 steel. Labor and material costs should range between $0.30 and $0.75 per pound of metal deposited.

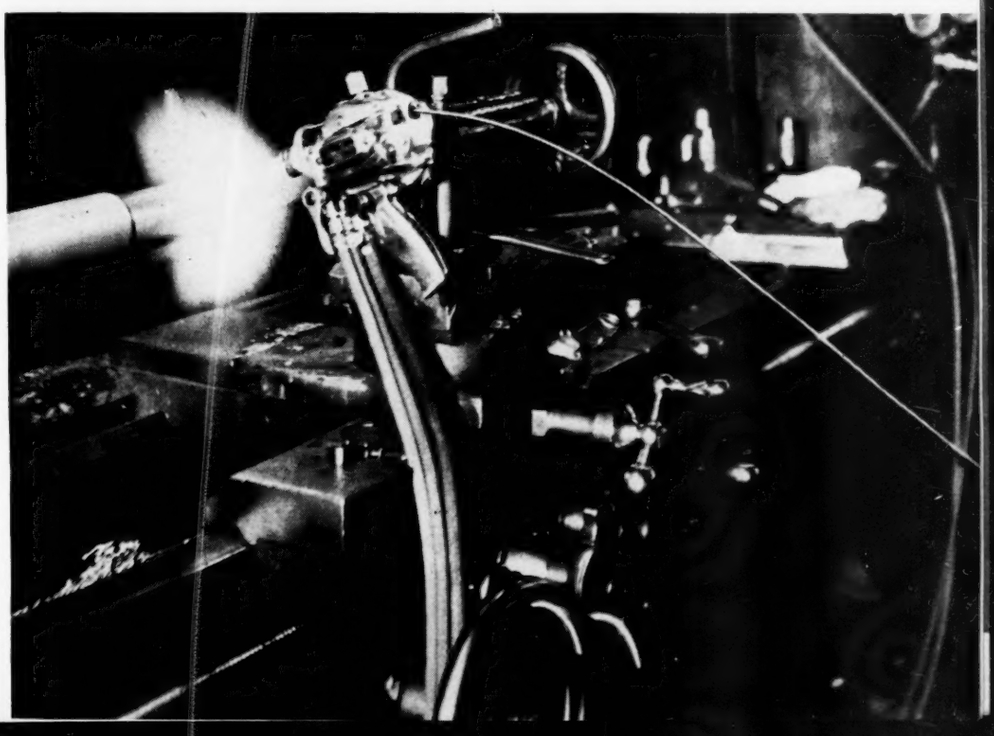
An example of a corrosion-protective coating applied by metallizing at mines is zinc on mine cars. It is put on to a thickness of approximately 0.02 in. Lead sprayed on pump casings is another example. The possibilities are numerous and include spraying zinc on steel structures to serve instead of paint.

Metallizing obviously is not well suited to a surface subjected to impact, excessive stress or very high unit pressure. Nevertheless its field in the coal industry is large. Journal or bearing sections for all shafts from electric motors to mine-locomotive axles and crankshafts of compressors and engines can be built up with the process. In addition there are the numerous jobs involving press, drive, shrink or suck fits. End shields of ball-bearing motors can be built up inside to a proper fit for the ball race. The same applies to hubs of car wheels and motor trucks.

On a mine locomotive an undersized wheel center can be increased to take a standard tire with the proper shrinkage fit or the controller shafts can be brought back to size at the ends. Collector rings on motors, generators and converters can be reconditioned. Pumps, both reciprocating and centrifugal types, can be treated by metallizing—the pistons, plungers, piston rods of the former and the shafts, impellers, sealing rings and sleeves of the latter. In short, metallizing fills the gap for reclaiming or protecting the many parts which are difficult to treat by welding.

As previously mentioned, Thermit welding is not at present available to the coal-mining industry. In addition to track rails, it also is applicable to heavy jobs such as welding broken frames of steam locomotives, large shafts and heavy parts. For these repair jobs, however, the skill and experience of a factory-trained man is advisable.

Metallizing to build up a worn shaft.



STRIP ORGANIZATION

Flexibility a Vital Factor in Organization Set-Ups—Supply Policies Influenced by Cost and Capacity of Production Units—Pooling Among Mines Cuts Inventories—Equipment Records Save Money All the Way Round

FLEXIBILITY is essential in most strip-mine maintenance organizations. If straight-line organizations were adopted and the principle of theoretical responsibility was strictly adhered to, there is a possibility that bickering and discord would interfere with getting results. What is believed to be a representative maintenance organization is shown in the accompanying chart, chosen because it works. It embodies a parallel rather than a series arrangement. Depending upon the conditions that may surround an emergency, it provides short cuts and eliminates the necessity for going through the superintendent to get things done when speed is essential. As can be seen, it provides for new bosses for the moment when conditions warrant.

All concerned realize that cooperation is necessary to get things done. Therefore, no one resents having a new boss for the duration of the emergency, and no responsible head insists on maintaining his theoretical authority when a breakdown stops the plant. If someone happens to be ill or away, there is no hitch.

The second major factor in efficient strip-mine maintenance, of course, is sufficient personnel with the necessary knowledge and skill to handle the job.

Maintenance also involves supplies as well as labor. The technique of ordering and disbursing supplies at a strip property is much the same as at a deep operation. Many of the supplies differ in character, however, being more expensive per unit, heavier and bulkier to store. Some are stored in the open where it is convenient for them to be handled by a crane. Parts catalogs for stripping machines are at least as complete as those for deep-mine equipment. Each shovel, drill and transportation unit is a major investment and its continuous operation a major factor in the success of the property—so much so, that accounting systems are set up to provide a continuous record of individual maintenance cost and performance.

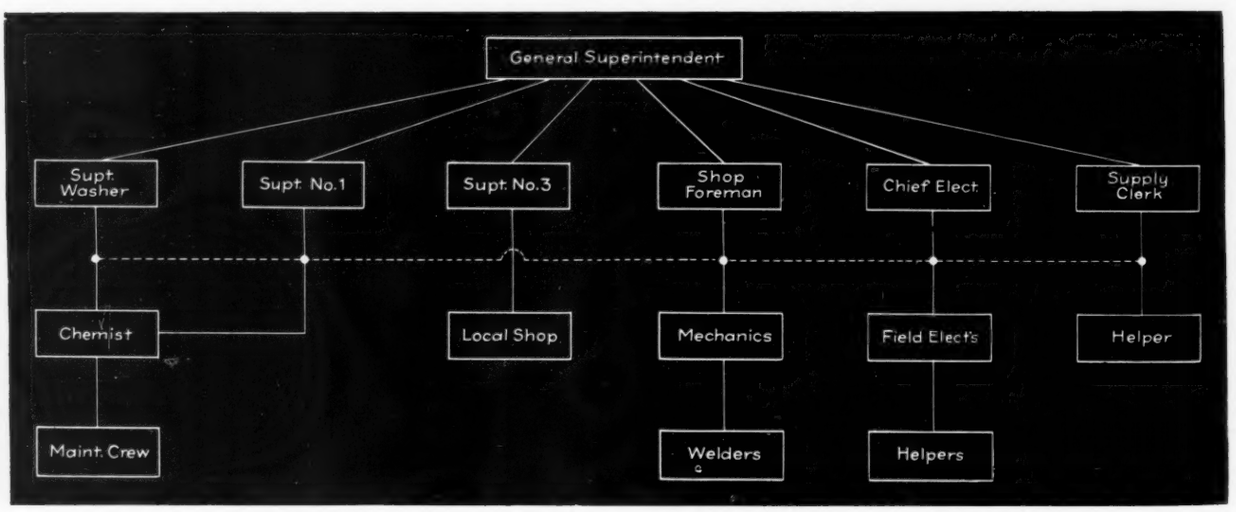
Perpetual inventories are maintained by many stripping companies, and receipts and disbursements, as a result, are subject to constant check. In the event an item fails early or wears out at an abnormal rate, interested men are called in for consultation to find a possible remedy. If advisable, the manufacturer and the oil company (if lubrication is suspected) are asked to pass judgment on the problem. Usually, such efforts supply the answer.

Because of the importance of shovels and other heavy equipment, the cost involved and the element of time, many orders for shovel parts are placed and followed by telephone. To hasten delivery, much of this material is shipped by truck. Through favorable resale discounts, shovel builders are encouraged to stock the electrical parts entering into shovel construction, and users are urged to place orders with the builders. Since many of these items are made especially for shovels, this is the preferred routine and should save time.

Storage space and stocks carried, as might be expected, show wide variations. The smaller stocks are at properties where working conditions are most favorable. Two common practices at strip mines serve to keep inventories of large and expensive parts at a minimum. The first is reliance on the shovel manufacturer for carrying these parts or fabricating them quickly from raw materials. The second is the good-neighbor policy existing among groups of mines in one locality. Exchange of parts and the practice of pooling armatures among several mines having like shovel motors save large sums in parts inventories.

The practice of keeping good rec-

The flexibility in organization desirable at strip mines is illustrated in this chart.

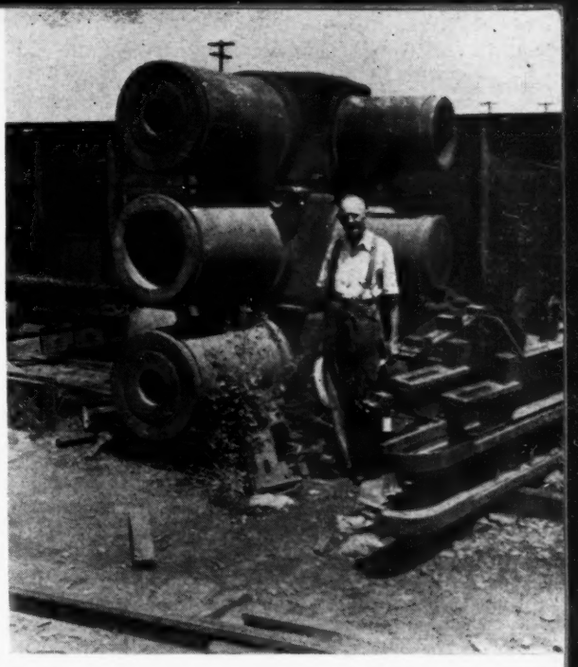


ords has been heartily encouraged by equipment makers. Electrical manufacturers many years ago inaugurated the practice of assembling into bulletin form information on renewal parts for deep-mine equipment. That practice has been extended by shovel builders to cover the complete mechanical and electrical parts involved in each machine—all in a single bound book. Wiring diagrams are laid out on blueprint sheets, which are folded and filed in a single envelope.

Drill, truck, locomotive, air-compressor and other equipment builders have followed suit, in addition to issuing elaborate bulletins on lubrication and maintenance procedure. Rubber manufacturers have been particularly active since Pearl Harbor in spreading the gospel of conservation as applied to tires, belts, cables and other items involving rubber.

Preparation-plant builders usually do a turn-key job, including all electrical equipment. Records furnished the customer, through the medium of blueprints, include a list of construction items. The makers of the electrical equipment are glad to supply complete renewal-parts data in bound form. When a breakdown occurs, these records are priceless. They can be relied upon and they quickly repay any cost involved.

Some deep mines keep the cost of maintaining individual machines. Others do not. Such a record is very important for a strip mine. Keeping the history of each shovel, truck, bulldozer, etc., may not be the general practice, but some mines find that such records, faithfully kept, are a well-paying step. Stripping equipment represents such large investments that owners naturally want to know which machine, which practice and which operator are the most profitable. Such records cost but little but may be worth a lot. If it pays John Farmer to compare the records of 2-gal. and 10-gal. cows, it should be worth vastly more to have the story behind 32,000- and 13,000-cu.yd. stripping shovels.



Stocks at stripping operations include items running into big money, such as these crawler axles for a strip shovel.

STRIP-MINE SHOPS

Stripping Equipment Is Precision-Built So Shop Facilities Should Be in Accord—Good Tools, Good Light and Good Conditions Are Essential—Separate Forging and Welding Quarters Desirable—Welding a Widely Used Tool

STRIPPING mines did not introduce mechanical mining, but they have been responsible for the development of many of the huge complicated machines that serve the coal industry today. Modern stripping machines include steels and alloys not available a few years ago and present-day workmanship has far outstripped that prevailing in earlier days. The micrometer caliper has become as familiar a tool in mining repair shops as a 2-ft. rule was a half century ago.

Except as to measuring devices and welding equipment, many shops, as a whole, still have some to go to match progress in equipment design and construction. Light to see and tools to match the machines are obvious essentials. This is not to say that good shops do not exist, but the best is imperative.

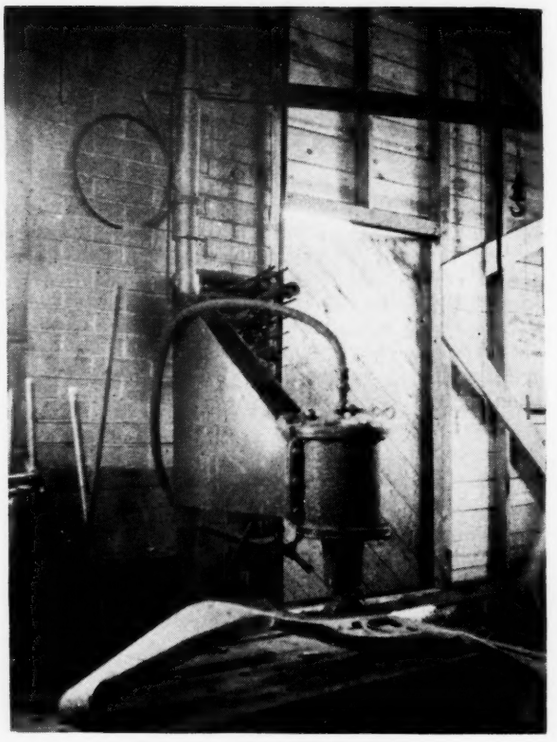
What are some of the characteristics of a good shop? First, it should have a concrete floor. Native soil is a poor substitute. Tools should be modern and heavy enough for the duty, not lightweight types a decade or two old. Plenty of room should be provided. Crowding tools results in poor work and inefficiency. Forging shops should be separate. Otherwise, a mechanic may have to lay off turning a long shaft while a drill bit is being sharpened because his tool chatters and the point may break. Welders should not be fenced off in a corner for lack of a good place to work. And the foreman should have an office adequate to his needs, with the proper files for his records and catalogs, instead of having to work at a stand-up shelf or some similar arrangement.

Smoke, dust, noise and static should be eliminated, along with flapping belts and other less desirable design features. A good environment has been definitely shown to improve both quality and quantity of work. Provisions for heating and perhaps cooling are obvious steps.

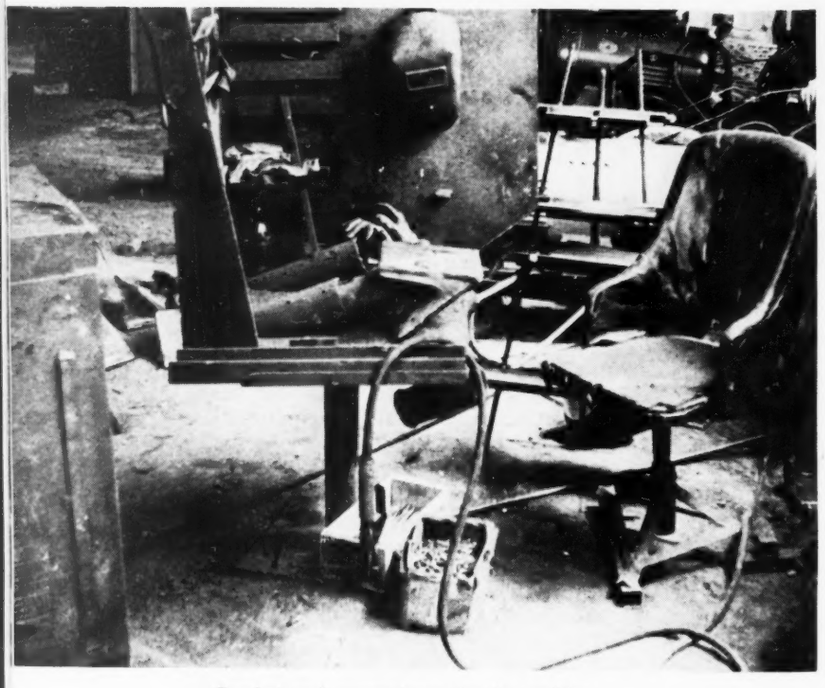
Some of the desirable features for a shop are exemplified in a new one shown in an accompanying illustration. It is a brick and tile structure with a concrete floor. In addition to abundant side light, it has windows the entire length on either side of the raised central bay. The light on a slightly hazy day measured 200 to 300 foot-candles, making the interior, in ordinary language, "light as day." This compares with around 30 foot-candles for the average shop and as low as 5 foot-candles at machine tools in some shops on sunny days. Incidentally, minimum illumination recommended by lighting experts for machine shops is 10 foot-candles, and for hospital operating tables, 100 foot-candles.

Another feature of this shop is a convenient supply room in the same building. A permanent wall separates the welding department from the machine-tool section. The central bay has a track for an overhead crane which

This new shop is as "light as day."

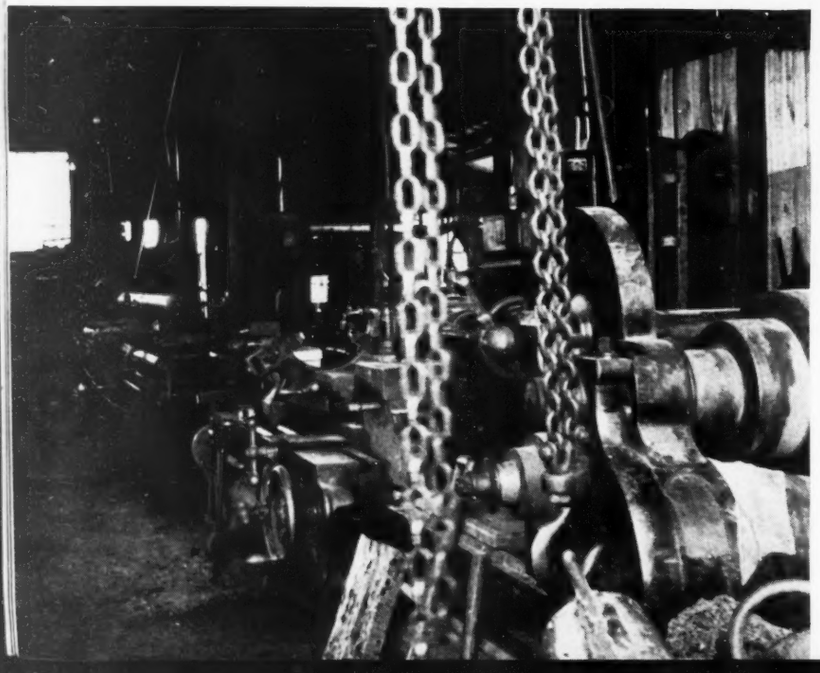


Home-grown air press.



Comfort and convenience for the welder.

Shackle for air hammer.



Left, tandem lathes machine 40-ft. shaft.

can travel from the entrance to the supply-room door.

What tools are needed in a strip-mine shop? Another shop may be used as a measuring stick. At this operation, notably, forging and welding equipment are in separate buildings for good reasons. The chief machine tools are a lathe, planer and radial drill, all heavier than usually are seen in this type of shop. Many heavy parts are machined that the average shop must send out or buy new. The quality of work is good. Heavy stripper shafts are machined on lathe and planer to 0.001 in. so that no delays will result in field assembly.

The smaller tools comprise lathes, drill presses, a heavy hacksaw, shaper, milling machine and grinders together with portable equipment such as drills, grinders and pneumatic tools.

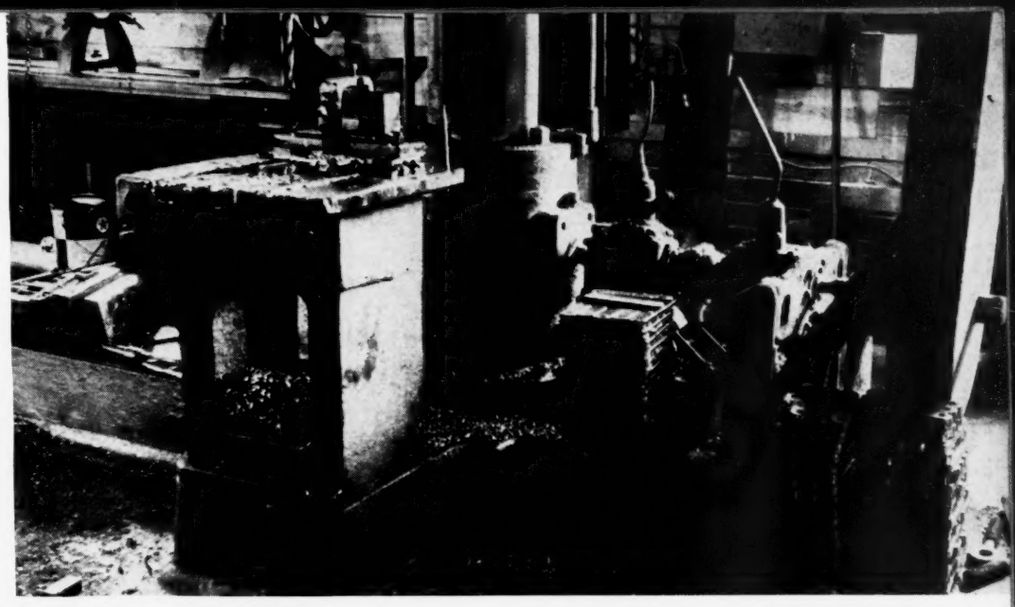
Billets Supply Parts

The forging shop contains, besides the customary tools, a large steam hammer, a very unusual tool at any coal mine. A stock of steel billets is carried from which various heavy shafts for the stripping shovels may be forged. Compared to stocking these parts, this has the maintenance advantage that it may be possible to make any one of several parts from a billet.

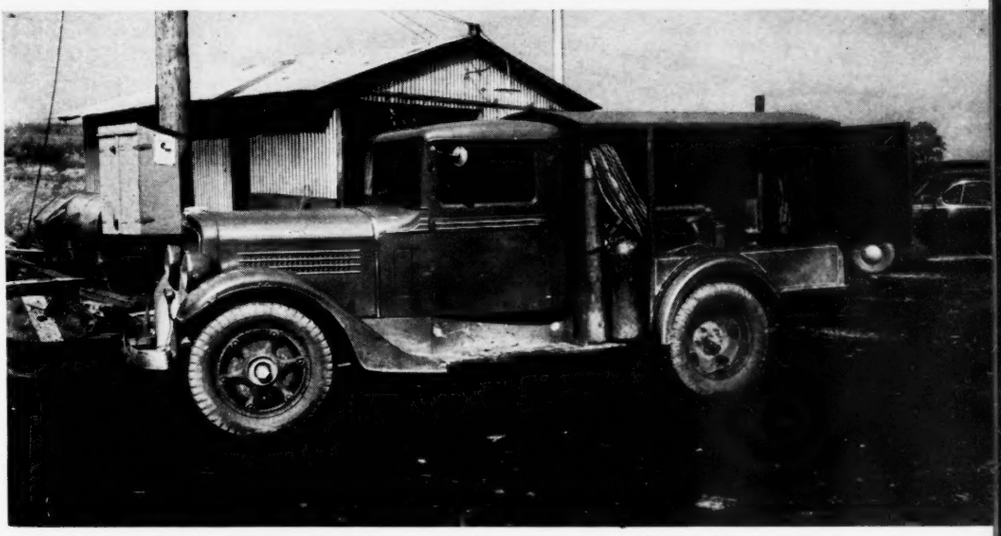
A possible additional reason for the better shop equipment at this mine is that standard-gage steam railroad equipment must be maintained. It might also be said, however, that no ordinary steam locomotive has heavier parts than big stripping shovels.

The separate welding shop is especially fitted to care for the usual work that comes in for repair or to have worn surfaces built up. Most of this work is relatively small so the shop need not be large. The chief advantage is that it is comfortable and convenient. It is noticeable that when a separate welding shop or room is provided, tools and conveniences are installed to expedite and improve work that are never present when the welder is shoved off in a cold corner of a big shop.

Not all the good tools and ideas are to be found in the two shops previously discussed. A shop with only fair-sized lathes had the problem of maintaining drill stems 30 ft. or more long, which was solved by its foreman. Two lathes were set up in tandem with the centers in the same vertical and the same horizontal plane. Pushbutton controls for the motors driving both lathes were mounted on



Jig for drilling conveyor links.



Completely equipped field-welding truck.

No. 2. No. 1 drives the piece and the carriage on No. 2 does the work. The mechanic, standing at No. 2, controls both. With a rod and universal couplings, No. 1 screw drives No. 2 screw as the headstock of No. 2 lathe must be removed.

Another shop manufactures the chain links for its washery conveyors. Steel bars are cut to length, the ends are rounded and then the blanks are clamped in a jig a dozen high with a hardened template on top. The template guides the drill accurately. In the same shop one of the mechanics made an air press from an air-brake cylinder with a discarded boom-socket casting for a platen. The air cylinder is 10 in. in diameter and will exert a pressure of about 3 tons. The platen is 3½x6 ft. The cylinder is mounted on a frame hinged to a vertical pipe and swings radially. The same vertical pipe carries a jib crane with trolley to serve the press and nearby forge. This is used both for straightening and for bending, and is considered one of the most useful tools in the shop.

Another device is a shackle to mount an air hammer above a blacksmith's anvil. This is a one-man tool for swaging boiler flues. The accessories are ordinary swage blocks of the correct size for the finished flue.

In 25 years the arc-welding machine has advanced from a "believe it or not" status to the most important tool about a strip mine. Some plants have as many as three or four. They do everything from patching a leaky pipe to welding a 30-yd. dipper to the stick. All sorts of portable rigs have been devised to reach a breakdown quickly and do the job thoroughly, and some operators have built special trucks (see accompanying illustration) with both gas and arc-welding outfits and the necessary tools and supplies. For more on welding, see article beginning on p. 113.

ELECTRICAL EQUIPMENT

Good Grounding Essential for Safety—Regular Inspection and Attention Keep Electrical Circuits and Equipment up to Snuff—Careful Cable Maintenance Prolongs Life—Certain Equipment Should Be Repaired Outside

PRACTICALLY all strip mines operate on purchased electric power. Mining-company responsibility usually begins at the 4,000-volt side of the power-company substation. Maintenance of such a power structure involves safety, continuity of operation and minimum power losses.

The customary layout for the 4,000-volt lines is a "Y" connection with a grounded neutral. To be nominally safe the following conditions must prevail: (1) The "Y" connection, or neutral point of the circuit, should be solidly grounded through a resistor, known as a ground protective device; (2) a continuous ground wire should extend from this ground protective device at the substation over the pole lines and through the cables, terminating on the shovels and field transformer stations; (3) several grounds should be established for the ground wire at points along the pole lines; (4) tripping devices and an oil circuit breaker should be installed to open the circuit in the event of a ground or short on the power wires. To prevent stoppage of all equipment in the event of a fault, fused cutouts or oil circuit breakers may be used to disconnect the faulted section.

Cable-joint projector.

For the further protection of men, many operators purchase high-voltage trailing cables with a copper braid outside each single conductor. These are in addition to the ground wires and in contact with them.

Low-voltage lines usually are 440-volt "Y"-delta connected. The phase voltage is 440 and in the event one power wire becomes grounded the voltage of the other two is 440 to ground. A limit of 256 volts to ground may be obtained with standard 2,300-volt 9-to-1-ratio transformers connected "Y"-"Y" to 4,000-volt circuits. This set-up gives a nominal secondary voltage of 444. While 440 volts usually is not considered fatal, under favorable conditions a much lower voltage has caused death. This further safety measure is easily put into effect at no added expense on a new property.

In any event, a ground detector should be connected to the 440-volt circuit so that a ground on one of the power wires is instantly indicated. This can then be run down and corrected before a short, with consequent power failure, occurs. A simple ground detector costing but a couple of dollars for material is described in the article on preparation-plant maintenance (p. 131).

Electricity is blamed for 6 percent of all coal-mine fatalities. Illinois records for 1940-41 list electricity as the cause of 15.4 percent of strip-mine fatalities. All these happened in 1941. Reading between the lines, these accidents might have been prevented by forbidding splicing of hot cables and adopting grounding of low-voltage transformer secondaries.

The routine for electrical-equipment inspection followed by one of the older strip-mining companies comprises both daily and weekly checks. Daily work covers: (1) cables, for power delivery and for damage to sheath; (2) motor-generator sets; (3) the controls of all stripping shovels; (4) washery motors, for cleanliness, heating and condition of bearings; (5) all operating complaints.

Weekly inspections take in: (1) power lines and transformers—more frequently if there is reason; (2) all shovel motors, with particular attention to commutators and brushes; (3) washery motor controls—more frequently if there is reason; (4) pit-pump motors and their controls. Neither motors nor control on most of the pumps are weatherproof. They are assembled so that a single cover protects both from rain. Whether the weather is wet or dry, these pumps usually are kept in locations where they will be needed if it does rain, and are always connected ready to go.

With correct fusing and lightning protection there is little likelihood of damage to overhead power lines or transformers, since manufacturers have done a good job. Satisfactory equipment is a matter of wise selection and correct installation. Modern electrical equipment for driving stripping and loading shovels, draglines and other equipment is stoutly built. Much of it is fan-cooled and the design is fairly well stabilized. Development, however, has not stopped, particularly in controls, which can stand much simplifying. The latter seems to be on the way, however—a break for the men of tomorrow.

There are some things that can be done for the machines of older vintage, such as circuit breakers to replace fuses controlling small motors. With the aid of a little arc-welding, blowers may be attached to older hoist and swing motors. Perhaps glass coils for the next rewind may last a good deal longer. Correcting washer power factor with the synchronous motors in the pit might will be abandoned with profit. Continued overloads should be avoided.

Cables are the most abused of all electrical equipment. Saving money and helping win the war might start with careful study of the limitations of the cable guarantee. Heat is the deadly enemy of rubber. Carrying capacity is reduced sharply by summer heat and by piling the cable up on the reel. A summer sun temperature of 122 deg. F. reduces carrying capacity nearly 30 percent; four layers on a reel reduce it 65 percent. The mini-

mum bending radius is 12 diameters of the cable to be dragged. That means never hitch a cable to a tractor with one rope. The fact that operating cables can be found that are 10 to 12 years old is an indication that long life can be obtained. However, it cannot be done by daily flouting of the rules.

Spliced cables properly vulcanized should be practically like new, except for the stiffness. Complaints about the results of vulcanizing may all be due to overheating. Care to prevent overheating will produce a good job if correct materials are used.

Tape Sometimes Used

A good many electricians successfully splice 5,000-volt cables using only a good rubber tape protected by a few layers of friction tape. One uses only friction tape, saturating each layer with a coating of insulating lacquer. He claims never to have had a failure in a high-voltage splice. Some of these lacquers retain their elasticity for a long time, withstand the ravages of weather very well and are oilproof.

Cuts, bruises and snagged places in the cable sheath should be attended to promptly. Perhaps cuts should always be vulcanized. Frequently they are merely taped over. The point about promptly healing small cuts is that it may head off big tears. Idle cables sometimes are permitted to lie in the field exposed to sun and weather. There is more than a good suggestion in the step taken by one electrician who had a shallow trench dug in which to bury idle cables. Ends were left exposed so that they could be pulled out. This is in line with the statement that buried street-lighting cables are good for at least 20 years.

There is another suggestion in the remark of an electrician eyeing a pile of cable too far gone for portable or highwall service: "We may have to string that up on poles."

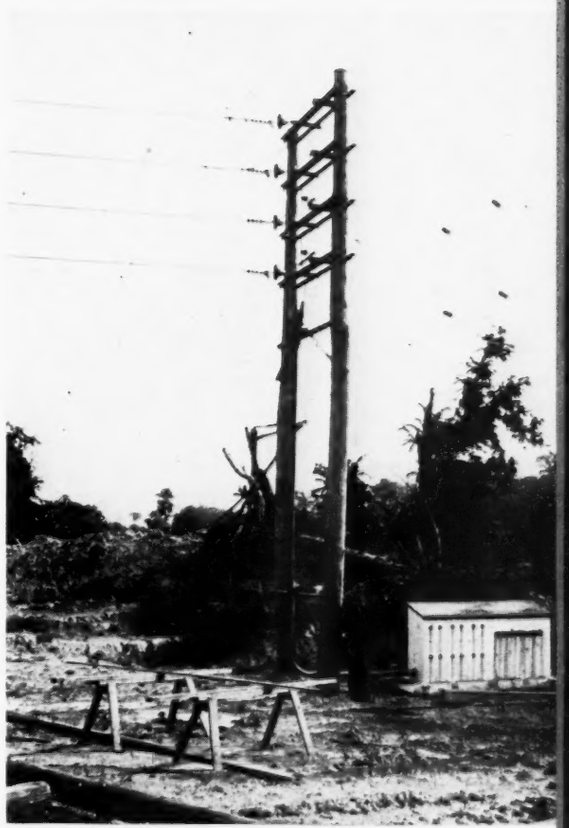
Even the best of connectors for portable cables are difficult to keep watertight. One resourceful electrician, taking no chances, has designed a weatherproof wooden inclosure. Partitions separate the phase wires, so it can be used to house a temporary splice without insulation. Joining ground cables to pole lines often is indifferently done. One way of making a good permanent connection is to use a pothead and conduit down to the ground. Cable connectors, such as those shown in an accompanying illustration, often are made up out of scrap wire salvaged from damaged cables. A bundle of these, just completed, is shown in another illustration.

Cable connectors made from scrap.

A major source of data on increasing rubber life is manufacturer's literature. This contribution to the war effort is free for the asking.

Switch houses for use in the field take many forms. Shown in accompanying illustrations is one built by an old-timer after long experience and investigation to meet the requirements of continuous service, portability and safety for operatives and maintenance men. It is approximately 5x8 ft. inside and 7 ft. high and is made of wood, with three windows and a door, and mounted on pneumatic wheels. Inside are two oil circuit breakers, three gang disconnects, relays for ground tripping and a fused connection for a cable to reach the portable transformer station for pit pumps, drills, portable floodlights, etc. The gang disconnects, with contacts incased in porcelain tubes, are built so that the metal parts of the contacts cannot be touched, but the porcelain separates enough to see that contact is broken. There is a disconnect ahead of each circuit breaker. The third disconnect is for the cable leading to the next switch station.

The two outside holes, near the floor, are for entering and leaving main highwall cables. The center two holes are for cables to the stripping and loading shovels. At the opposite end of the switch house is an 18-in. wide work bench under the window.

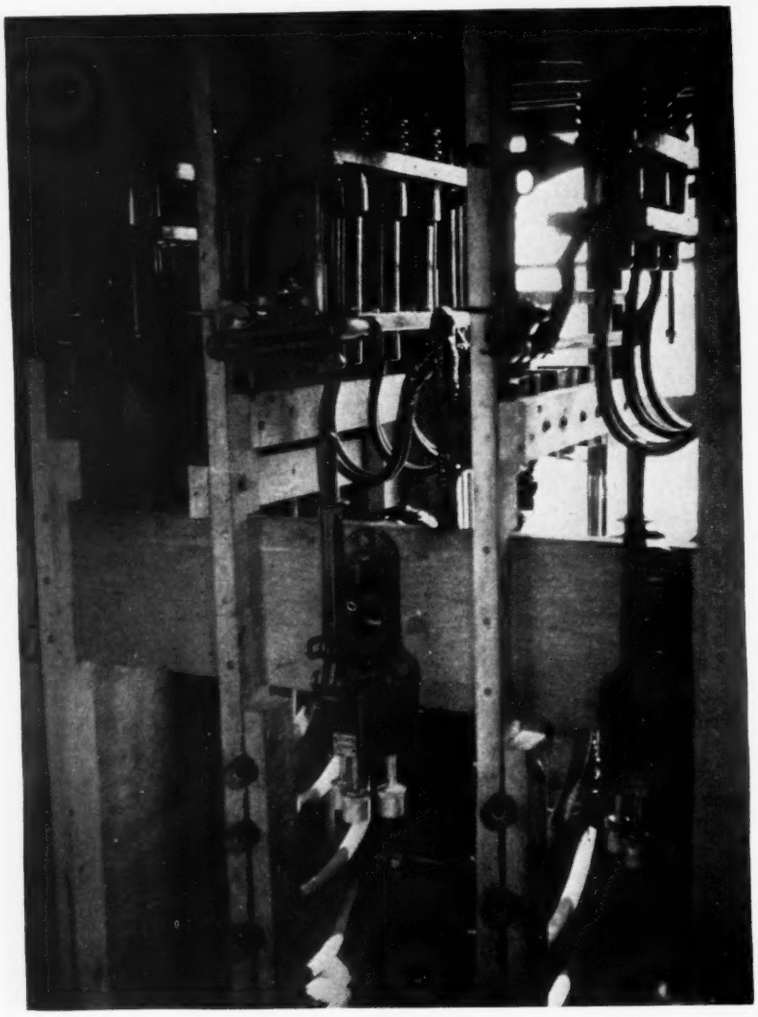


Pothead connection from the pole line to the ground cable.

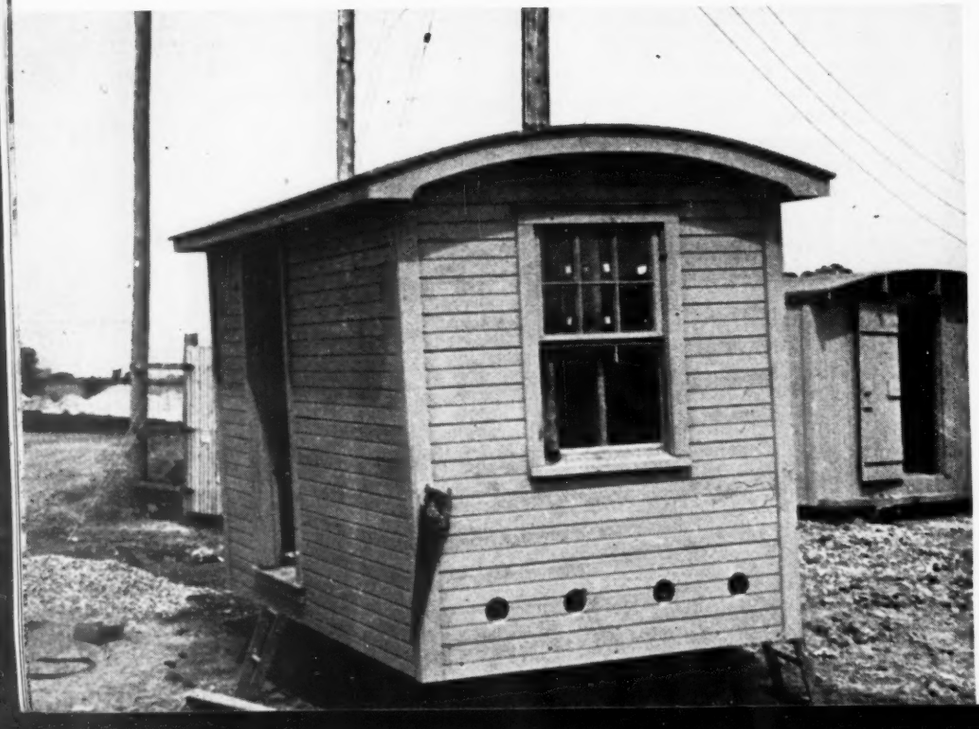
This provision for a clean well-lighted place to work is a new wrinkle calculated to speed repairs when time counts in production.

Inspection, frequent moving of cables and follow up on minor repairs

is a continuous job. Most operators find it better to have generator and motor rewinding done in commercial shops with equipment and trained men to turn out a good job. The operator usually can take his choice between local shops and manufacturers' service shops. Normally, the latter are conveniently near by and are set up to do a factory job.



Oil circuit breakers and safety disconnects in switch house.



Switch house on rubber-tired wheels.

Small transformer burnouts are another story. Building small transformers is a highly specialized art. Much of the work is mechanized. Undoubtedly, all manufacturers are set up to supply, off the shelf, built-up cores and coils for any of the small sizes on their list. The mine electric shop can quickly change a new assembly for the old. The manufacturer may have an exchange proposition that is advantageous. Either of these methods results in a new transfer—and no guesswork. In the event a high-voltage or large transformer is damaged—something that seldom happens—only the builder should be permitted to repair it.

There are two reasons why duplicate small motors and controls—say 25 hp. or less—should be carried in the supply room. Firstly, in the design of a complete plant it is possible to have a number of these small sizes that are duplicates. Secondly, failures are more likely in the small sizes. This leads to the conclusion that there should be a detailed record available in the supply house, electrician's shop and superintendent's office of all motors and controls about the plant, together with their location. Some day it will save the entire cost of the list —and more.

Better Light Desirable

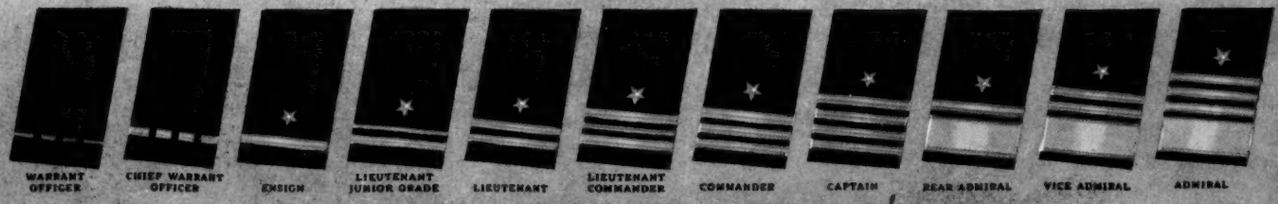
Multiple shifting, complicated machinery and demand for a better product all point to more and better light. There is no maintenance tool better than plenty of light where it is needed. The electric light, constantly being improved, performs that service with signal success today. Still, there is something to be said about its possibilities and its defects, and what to do about some of them.

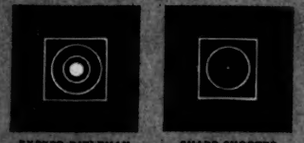
Most important is lighting circuits independent of power circuits. When the power goes off, light certainly is needed. Such separation makes it possible to use strong 110- and 32-volt lamps in preparation plants and on shovels where vibration may destroy the filaments of 220-volt lamps. Theft is offered as a disadvantage of the 110-volt type. One electrician counters with the declaration: "We could better afford to keep our men in lamps than buy the enormous number of 220-volt lamps we used to break." He now uses 110- and 32-volt types.

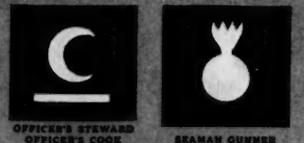
Many coal mines are trying fluorescent lighting. The light is pleasing. Power consumption for the same volume of light is about 40 percent. It is

Uniform insignia - United States Navy.

Uniform Insignia – United States Navy.







* INDICATES SEAMAN BRANCH

OFFICERS' CORPS DISTINGUISHING INSIGNIA

COMMISSIONED AND WARRANT OFFICERS

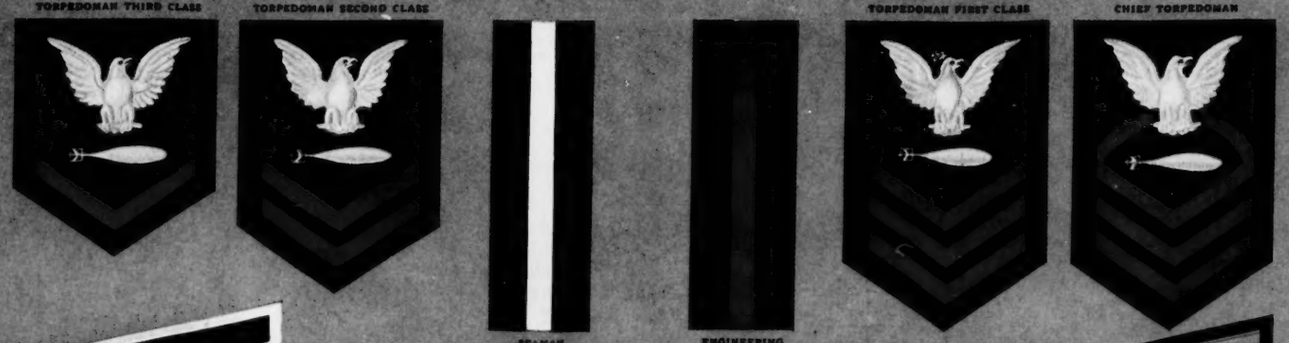
The rank of an officer is indicated by the number and width of stripes on his sleeve and shoulder marks. In addition to the insignia of rank, officers of the several corps and warrant officers wear corps devices one quarter inch above the stripes.

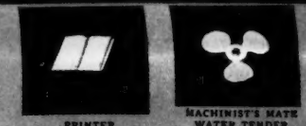
CHIEF PETTY OFFICERS AND PETTY OFFICERS

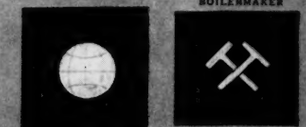
The rating badges, consisting of eagle, chevrons, and specialty mark, of chief petty officers and petty officers first, second and third class are worn on the sleeve midway between the shoulder and elbow. Petty officers of the seaman branch wear rating badges on the right arm, other petty officers wear them on the left arm.

SEAMEN, FIREMEN, MESSMEN

The branch and class of a non-rated man is indicated by his sleeve and cuff markings. Men of the seaman branch wear on the right shoulder seam, a white braid on blue clothing and a blue braid on white clothing. Engineer's force wear on left shoulder seam a red braid on both blue and white clothing. Messmen wear no branch mark.







BUY U. S. WAR BONDS — REGULARLY EVERY PAY DAY

THE LOUIS ALLIS CO., MILWAUKEE, WIS.

not yet portable. Two defects have been pointed out by coal men. The first is that the starting equipment becomes defective and fails. One superintendent overcame that difficulty by letting them operate 24 hours a day. That was not bad in his case for the mine operates two shifts. In application in a washing plant vibration shook the tubes out of the receptacle, since the holding device was too weak to carry the weight under vibration. These defects undoubtedly will be remedied in the course of further development.

SHOVELS AND DRAGLINES

Most Vulnerable Points Are Ropes, Dippers, Sticks and Caterpillars—Lower Cost Repays Good Rope Maintenance—Welding and New Steels Help With Dippers, Buckets and Teeth—Other Parts Reclaimed by Welding

PERHAPS the four most vulnerable points on shovels and draglines are wire ropes, dippers and buckets, dipper sticks and caterpillars. The most important item is lubrication. Even that can be overdone. It is difficult to visualize a steel structure like a shovel "burning up." Yet that very thing has happened, aided by superfluous grease and a reeled trailing cable.

Cost of a large modern electric stripping shovel is nearly half a million dollars. For a 200-day working year, depreciation and interest, each at 6 percent, aggregate $300 each working day. Compared with that, $10 or $20 a day for lubrication is a small item. And, while the fire hazard seems nil, the cost of fire protection is trifling in comparison with fixed charges or the cost of a fire. Furthermore, considering the cost of a stripper and the economic value of cleanliness, a "hostler" might be a good maintenance investment.

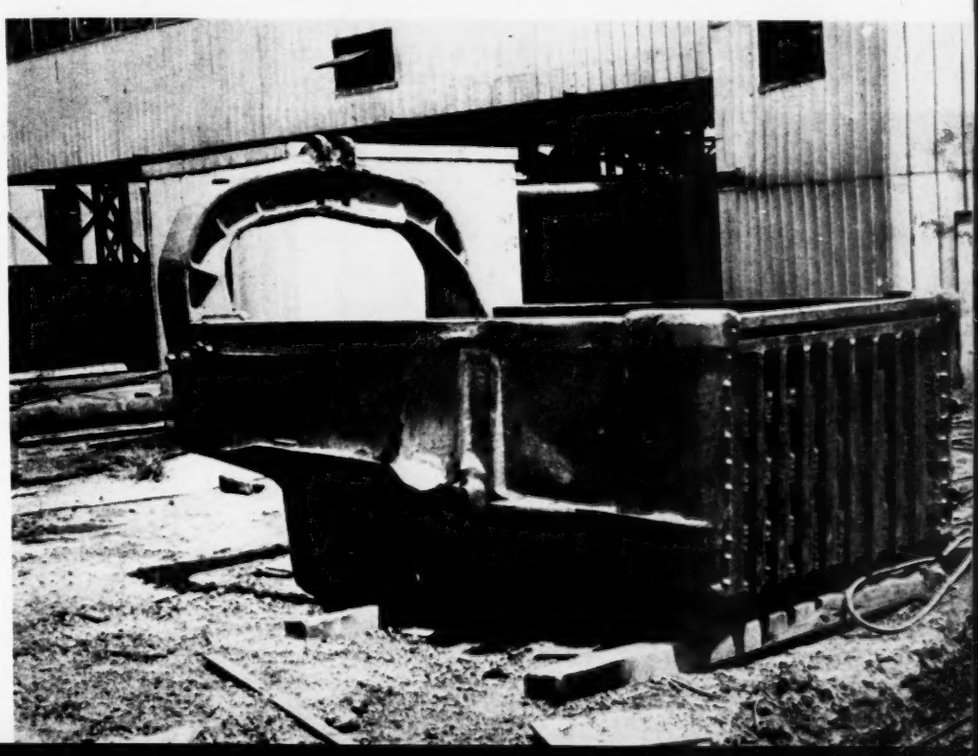
Much can be done to prolong the life of wire ropes. Manufacturers always are ready to assist. Practice may vary somewhat but the principles are the same. Exemplifying many accepted practices, hoist and counterbalance ropes are inspected twice weekly by the head of the operating department at one strip mine, who looks for signs of wear or damage that would indicate a rope must be changed. However, any indication of impending failure, like snapping of a wire, will be noticed by the shovel operators, who see the frayed wire or hear it striking the roof of the cab or elsewhere. Other visible indications of the approach of failure of auxiliary hoist ropes are: crushing of the hemp core and resulting smaller diameter, oozing of rusty particles from between the wires and actual wear of the wires from abrasion.

It was observed when both auxiliary ropes were right-lay construction, one rope failed much sooner than the other. So the short-lived rope was changed to left-lay, which change increased life from 700,000 to 2,000,000 cu.yd., or almost threefold. Stretching of one of the counterbalance hoist ropes with loss of diameter, so that the equalizing bar changes position, indicates that it is time to change that rope. Each hoist rope is shortened four times during its service period to expose a new section to the equalizer sheave on the dipper. This sheave has a pitch diameter of 32 in. Rope diameter is 2 in. and a 2-ft. length is cut off each time.

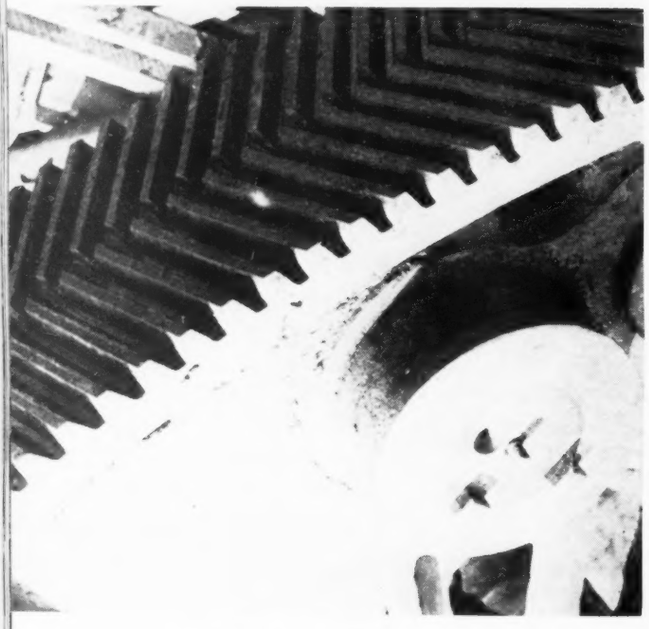
The cause of a rope failure often can be determined by the appearance of individual broken wires. A wire broken short off, with no reduction of area, might mean the life of the rope from the bending standpoint had been reached. A reduction in area at the break is an indication of overstress, particularly if the break is cup-shaped on one side. The diameter of sheaves is an important factor in the life of wire ropes. The permissible minimum is said to be 27 rope diameters. All these factors are observed at this time. Maintenance of wire rope is further discussed in the article starting on p. 110.

"The maintenance of a cast manganese steel dipper is less than that of a dipper made of any of the new high-tensile steels," but such lightweight dippers have been widely installed because they carry a heavier payload. A dragline with a new steel rear end riveted in is shown in an accompanying illustration. Notable are the numerous ribs welded on the sheet to keep it from buckling. The welded section is riveted to the manganese-steel sides because this shop foreman says "it is not advisable to weld manganese steel if it can be avoided." When a dipper or a bucket is overhauled no expense is spared to make it strong. Where cast manganese

Revamped dragline bucket.

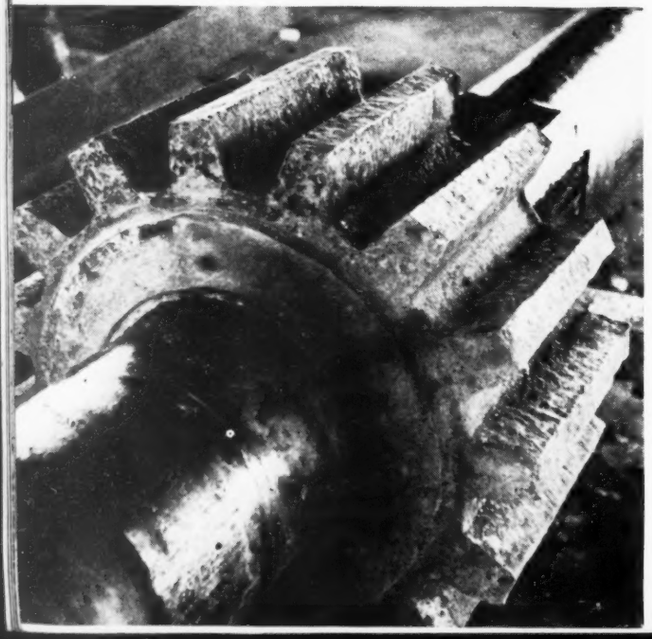


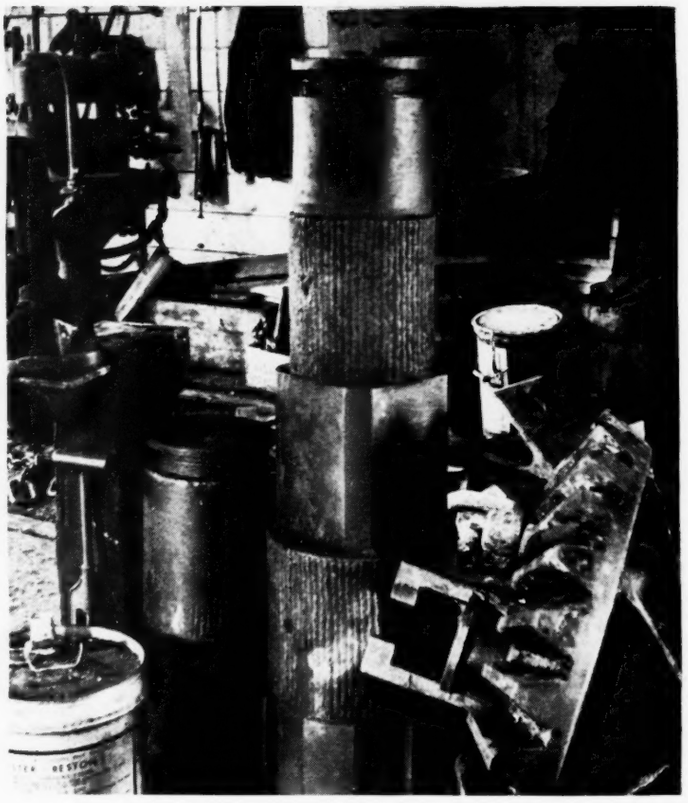
High pressure and shafts out of line resulted in deformation of these teeth.



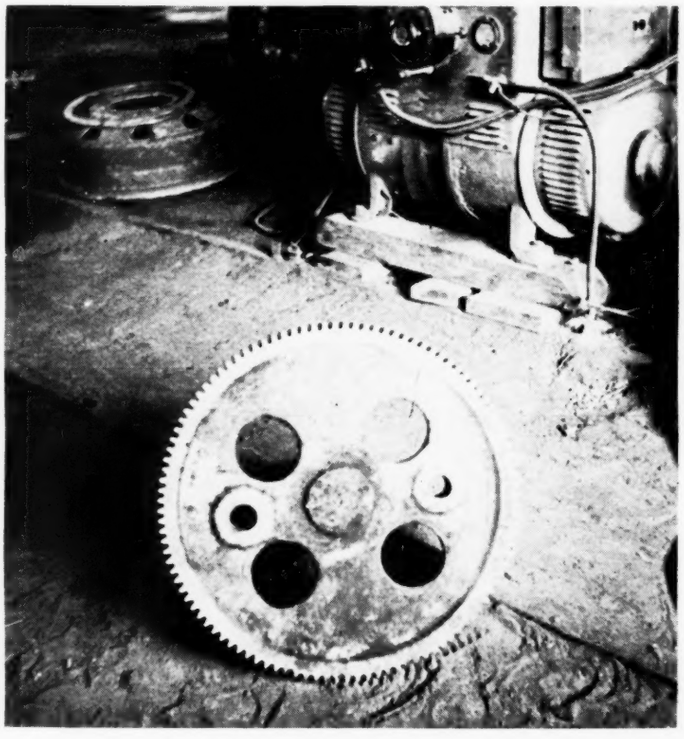
This hoist gear, correctly aligned and lubricated, shows no apparent wear after 15 years of service.

Crawler pinion built up and "washed" into shape with the acetylene torch.





Beads parallel in building up large shafts is the usual practice.



Dipper tripping gear with added crank-pin mounting

steel parts are required they must be bought.

Dippers are attached to the sticks in various ways, including bolting them to hangers, attaching them to a revolving swivel or welding them solidly to the stick. Welded attachments, however, have been subject to considerable breakage. Attempts to solve the difficulty have been by applying more bracing and rewelding.

Dipper teeth on shovels handling considerable hard rock are changed at 3- to 10-day intervals. The average seems to be about 5. The removed teeth usually are built up in the mine welding shop. One mine has discovered that it is more economical to use but one side of the tooth and change at about 3-day intervals rather than turn them over and wear both sides.

The dippers on loading shovels are not subject to the abuse stripping dippers get. Two aluminum dippers observed at widely separated mines show some cracks in the aluminum that have not widened. These dippers, 6 and 9 years of age, look almost as good as new.

A very recent loading shovel has a central web in the middle of the 7-yd. dipper for stiffening both front and back. It also has rubber bumpers on the bottom of the door to absorb the shock of the swing as it opens. The same dipper has side teeth (riveted on) to cut the "rib." These appear to be useful additions whether they materially reduce upkeep or not.

Teeth Are Welded

The teeth of loading dippers may be built up or forged. In the latter case, when badly worn, either of two methods are used: (1) The necessary material is arc-welded on and then forged to shape, or (2) manganese nickel steel wedge bars are used to repoint the teeth by arc-welding.

Balancing weight against useful work makes it quite a problem to design a dipper stick that will give lifetime service. None of the types so far produced seems to be immune to wear or to distortion and breakage. Those built up from timbers and plates or rolled shapes and plates are removed from the machine, taken to the shop and rebuilt. They then replace the next failures. To keep sticks of the tubular type from getting brittle in cold weather and cracking, electric heaters have been installed inside them (September, 1941, *Coal Age*, p. 53). Similar heating also has been extended to certain dipper parts. Fig. 2 shows how the torsion plate on one pair of dipper sticks was "drilled" when there was no drill available large enough for the job. Use of high-tensile steels in the construction of replacement sticks has shown substantial growth for obvious reasons.

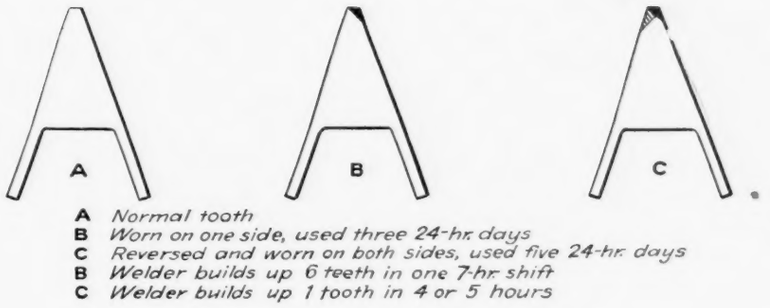

A
B
C
A Normal tooth
B Worn on one side, used three 24-hr. days
C Reversed and worn on both sides, used five 24-hr. days
B Welder builds up 6 teeth in one 7-hr. shift
C Welder builds up 1 tooth in 4 or 5 hours

Fig. 1—Turning and building up dipper teeth.

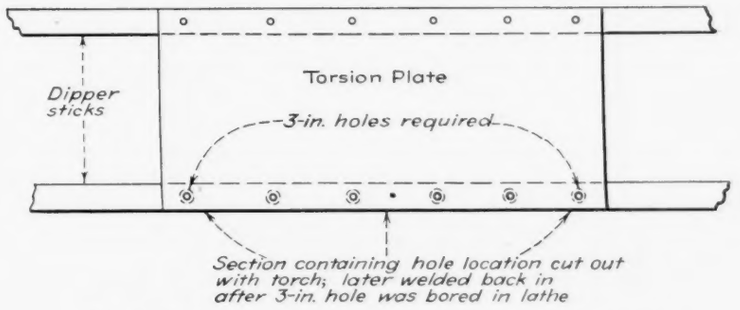

Dipper sticks
Torsion Plate
3-in. holes required
Section containing hole location cut out with torch; later welded back in after 3-in. hole was bored in lathe

Fig. 2—"Drilling" a dipper-stick torsion plate without a drill.

Not only the mud and water caterpillars have to wade through and the immense load they have to carry but the rough road they travel invites breakdowns and makes lubrication difficult. This is particularly true of older machines not provided with gear inclosures and also loading shovels which must wallow through the deepest mire that clay and incessant rains can produce. Welded pads appear to be better than the original, as they never seem to break. Building up cast manganese steel driving sprockets is more of a problem, as the welded portion sometimes peels off.

Because of the difficulty of lubricating caterpillar parts and the effect of water carrying grit it is difficult to prevent shaft and bearing wear. Older machines are especially subject to this difficulty. Wear, once begun, progresses rapidly, resulting in shafts getting out of line so that the pressure is carried by one end of the gear and pinion teeth, causing the metal to flow. On the other hand, the hoist gear, shown in an accompanying illustration, shows no apparent wear after 14 years of service, indicating good lubrication and perfect alignment.

Building up caterpillar gears is rather common, but not all do as neat a job as is indicated in another illustration. These teeth were "washed" with an acetylene torch after being built up. The uniform shape and correct tooth form indicate that the mechanic appreciates what a gear tooth should be.

Worn shafts are built up by laying the beads parallel to the shaft length. Besides warping the shaft less than laying the bead on spirally, there is much less danger of the shaft breaking at the end of the weld. With the renewed shafts, new sleeve bearings are inserted in the caterpillar frame, making all dimensions the same as new.

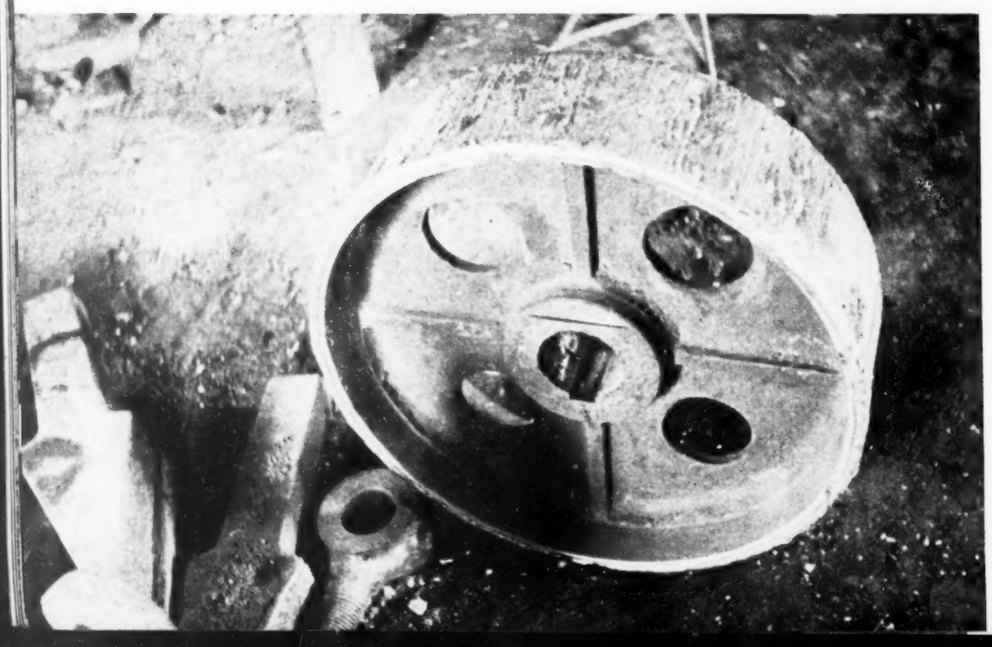
Mines without boulders and no more than a foot of laminated rock are fortunate. Where rock is encountered, perhaps the most important preventive maintenance measure is the preparation of the high wall. Sufficient properly located drillholes, shot with the best shattering explosive, are necessary to prevent breaking shovel teeth and dipper sticks, straining the machine and overloading the electrical equipment. Nothing the shovel runner can do will overcome the evils of poorly shattered rock and boulders.

The economics of stripping is not all in the cost of high-wall preparation per ton of coal. It also involves idle shovel time for repairs and con-

High-pressure steam outfit for cleaning machinery.

Laundering equipment parts with steam.

Built-up brake wheel for stripping-shovel hoist motor.



sequent loss of tonnage, as well as the extra money for repair parts and labor involved. Added to this is the possibility of a hidden strain or crack that may not develop into a breakdown for a week, a month or a year.

The fact that a stripping shovel looks as strong as a battleship does not license the operator to attempt stunts for which it was not designed. Every machine is limited by the strength of the materials with which it is built.

Operators of shovels with individual motor drives on each caterpillar should not overlook the fact that these motors are intermittently rated for very short periods of time. A check should be made with the builder and on the motor to be sure the limits of both time and current are not exceeded. It is well to remember that guarantees are voided when these limits are topped. This applies to all electrical equipment and is the responsibility of the owner.

Brush Holders Help

The commutating characteristics of heavily loaded hoist generators have been improved by substituting "V" brush holders using twice the number of thinner, light-weight brushes. The idea is that lightweight brushes follow an uneven commutator better, while doubling the number of brushes reduces the chance of one leaving the commutator.

As time passes, more and more shovels will be torn down and removed to new locations. Unless parts are clean and free from rust and grease, a good job of rebuilding cannot be done. If the job is well done, maintenance will be in line. One of the best devices that have appeared for this work seems to be the high-pressure steam outfit also referred to in the truck-maintenance article (p. 128).

Another of the many kinks evolved at strip operations is the revised dipper-tripping gear shown in an accompanying illustration. This gear normally has but one hole for a crankpin, with consequent tooth wear, by reversing the motor, on each side of the crankpin position. To double the life of this gear, a boss is welded on the disk opposite the original crank position and a second crankpin mounting provided. This extends the wear to two more positions. After the four points are worn in the gear, the teeth are filled by arc-welding and the "blank" is sent to a commercial shop to be recut, giving the gear two new lives.

DRILLS AND PUMPS

Prospecting Outfits Simple—Sharpening Bits and Attention to Drill Stems and Augers Biggest Jobs With Overburden Drills—Pit Pumps Should Always Be Ready for Service—Regular Inspection and Overhauling Needed

FIELD DRILLING at strip operations falls largely into four classes: (1) prospecting; (2) overburden where there is heavy rock, usually drilled from the high-wall; (3) overburden with thin rock or hard shale; and (4) coal ahead of the loader. The first two usually are far enough ahead of stripping that time out can be taken to do any repair job. That is not true in all cases with the second two, however, which often must go along with stripping and loading.

Equipment for prospecting normally is very simple, usually consisting of a home-constructed auger drill mounted on a farm-type or other tractor, or a churn-type unit on a truck chassis. The auger drill may be used for drilling clay and shale, with the churn drill for rock and coal, and they may operate as a team. Maintenance of these rigs is confined largely to drill sharpening and changing auger bits.

Good Shooting Helps

Where there is hard rock to handle, maintenance of the stripping shovel is greatly reduced by a closely drilled well-shot high-wall. Considering the monotonous pounding a churn drill gets, it and its equipment stand up remarkably well. The usual 15-hp. slip-ring motor seldom fails. Most are equipped with ball bearings which stand the pounding far better than plain bearings. The chief point of electrical failure is the starter. One stripping mine found it necessary to abandon pushbutton control, which fell apart, and substitute fused knife switches. In this case, even standard renewable fuse links failed. The trouble was overcome by soldering the correct size of copper wire into the holder as a fuse. Tables of fusing currents for copper wire appear in engineering handbooks. A fourth fuse holder was added in series with a lamp. This carries a spare fuse and serves quickly to find the one that has blown.

Sharpening drill bits, of course, is a continuous activity, and good or modern equipment makes for efficiency. Drill stems come in for rethreading the screw ends, a machine-shop job. One shop foreman claims to have materially increased drilling speed by welding two stems into one long unit to overcome the cushioning effect of the threaded joint.

The modern rotary drill, copied from oil-well drills, has been introduced in recent years. While one of these drills may replace four or five churn drills, bits and drill stem require considerable maintenance. Building up worn rotary bits was described in the October, 1940, *Coal Age*, p. 134. Original drill stems were rather thin and worn through on the corners, permitting water to leak out. This has been overcome by making stems at the mine shops by welding together two $3\frac{1}{2}$x4x$\frac{1}{2}$-in. angles into a hollow 4-in. stem. When a stem becomes kinked it is straightened by peening on the hollow side with an air hammer. Worn corners of these rods are built up as indicated in Fig. 1.

Most of the upkeep on the sidewall drills is compensating for auger wear. The worn edge of the auger is built up by arc-welding. A convenient aid for this work is two discarded ball bearings in which the ends of the auger stem rest, making it easy to rotate as work proceeds. While jack-hammer air drills still are used, most coal drilling is with motor-driven vertical auger drills on rubber-tired wheels. The work is light. Removable bits make sharpening unnecessary.

While pit pumps are not actually kept primed, many operators have learned the importance of getting a pump into action when the rains come. One operator has this 3-point program calculated to keep pumps always ready: (1) Pumps in the pit always are connected to power and to a water hole ready to turn over at the first sign of rain; (2) every pump has provision for priming by exhausting the air from the pump and suction line. Large pumps are supplemented by a hand-operated tank-wagon pump permanently mounted on the pump sled (see accompanying illustration). Small pumps have provisions for attaching a portable air pump; (3) during the "dry" summer season each pump is overhauled, the motor and starter protection are renewed and the whole assembly is repainted. Pump maintenance is further discussed in the article beginning on p. 103.

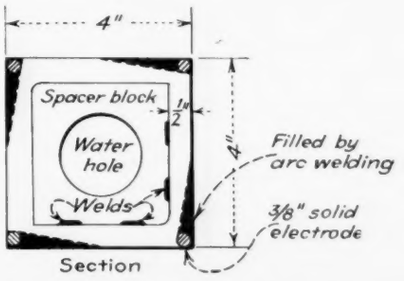
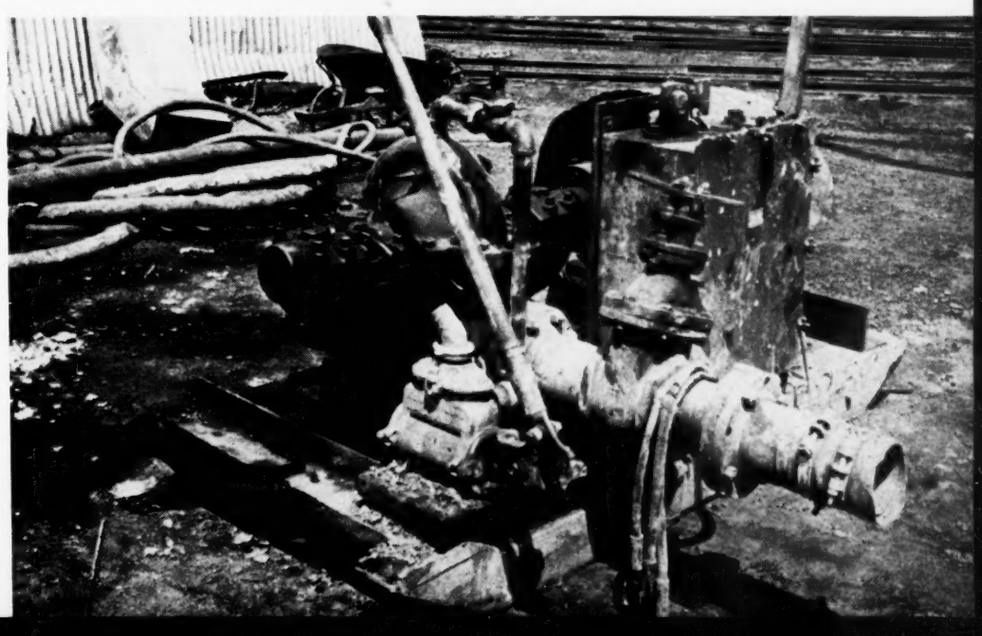


Fig. 1—Rebuilding rotary drill stem.

Tank pump mounted with pit pump for priming.



TRUCKS AND TRAILERS

Good Roads a Primary Objective—Engine Type Has Big Influence on Maintenance—Operating Records a Helpful Tool—Regular, Thorough Lubrication a Necessity—Best Possible Tire Care is None Too Good These Days

GOOD roads are the first essential in reducing maintenance on strip trucks and trailers. However, even good roads do not eliminate all breakage of axles and spring shackles. As will be related, axle breakage at one mine was the fault of construction rather than the loads carried. At another mine, improving the roads stopped all spring breakage, as evidenced by a three-year-old stock of untouched springs.

Most strip mines have a road-maintenance crew of two or three men operating graders and sprinklers throughout the working day. Thus roads are kept from getting rough or washboardy. This maintenance extends down into the pit. Sprinklers are bought or devised. Those bought are tank trucks. Those devised may be a tank set in a truck, a coal truck with solid bottom welded in or a tank trailer hauled by a farm tractor. The latest graders combine a scraper with a scarifier and are hydraulically manipulated. Besides saving trucks, tires and fuel, maintained roads provide a clear right of way for the driver, permit higher speeds (up to 40 m.p.h.) and promote safety.

Long hauls from pit to preparation plant are responsible for the trend to high-capacity trailers. There is little sign that maintenance is much increased, except as influenced by load.

The types of engine and fuel used have a definite influence on operating and maintenance cost. The present trend is to diesel engines, with some using butane as fuel. Both fuel-oil and butane engines are practically free from carbon deposits and sticky rings and require less frequent overhauls than gasoline types. Diesel engines with their removable cylinder liners are quickly overhauled and standard dimensions are maintained. Gasoline engines, with their solid blocks, change dimensions with every cylinder grinding.

One mine now converting to diesel overhauled gasoline engines every eight months. Its first diesel overhaul was at the end of nineteen months. Still another mine sent in its first diesel at the end of three years.

A very few fluid drives are in service—scarcely enough to create opinion as to their value or to indicate their effect on maintenance. All the benefits are not likely to be learned until a full fleet is serving a pit. A single fluid drive in a fleet has brought criticism without indicating its probable advantage of lowered maintenance cost.

Rebuilding a fleet can materially increase capacity and lower maintenance cost. As an example, one operation began with a short haul and 15-ton four-wheeled trucks. It later became necessary to revise haulage when a new pit was opened three miles out. The chasses were converted to tractors, the bodies discarded and new 35-ton semi-trailers were added. Diesel engines were substituted for the original gasoline engines. The rated horsepower of the diesels was boosted from 150 to 200 by V-belt-driven rotary superchargers. A fifth wheel was added to accommodate the connection for the new trailer. This was purchased outside. An air compressor with V-belt drive was mounted on the engine. This supplies air for operating brakes and the side-dump doors, one on each side. A small oil tank, made from 3-in. pipe, was mounted on the chassis to drip oil on the drive chains. The rate is regulated by petcocks.

This revised outfit has two single-tired steering wheels, two double-tired traction wheels and two double-tired trailer wheels. With doubled capacity, reduced engine maintenance and lower fuel cost, this rebuilding program, involving twelve trucks, has fully justified itself.

For a fleet of a dozen trucks, the maintenance crew usually is made up of a foreman, two mechanics and a greaser. The foreman necessarily has other duties than merely giving orders, keeping records and handing reports to the superintendent. He does much of the inspection to keep up with the condition of the equipment and now and then may have to turn a hand in repair work. Truck maintenance calls for all-round knowledge and cooperation. Lubrication being the most important preventive work, mechanics usually will devote more time to it than to actual repair.

Keeping records begins with the truck driver and ends with the monthly report turned in to the superintendent. The driver should file a report at the end of the day showing mileage, fuel used, trips or tons hauled, delays and their cause and any operating or mechanical difficulties that occurred or

Well-maintained roads keep maintenance low.

are indicated. It is the basis for particularized garage inspection and repair. This information also should be transferred to a daily summary covering all trucks, to which is added the results of garage inspection, parts and supplies used and time charged to repair work. In this way, an operating and maintenance record is preserved for each piece of equipment. Such records should be kept in the garage office files. The daily summary is transferred to the monthly report for the superintendent. Copies of time and material reports are sent to the executive offices for maintenance cost distribution on the corporate records.

One company maintains an individual card record for each tire. This gives dates of service, repairs made, where used and dates of changes with mileage elapsed on that date. Service mileage varies widely. Cards examined indicated an average mileage of over 30,000, with one tire topping 49,000. This fleet of trucks works in the pit, delivering to a rail transfer station.

Clean With Steam

Inspection and lubrication practices, of course, are not uniform, but follow fairly well defined patterns. Because a good repair job cannot be done on a part smeared with grime and grease, several mines now use high-pressure steam outfits for cleaning the part before it is removed from the truck, following up with an internal "wash" after removal. One enterprising supply clerk provided a special washer for ball and roller bearings which does a better job of cleaning than can be done by hand.

The formula religiously followed with diesel engines (no superchargers) at another mine is: (1) At each change of oil, wash the outside of the engine with an atomized spray of kerosene and flush the motor; (2) change the oil after every 50 hours of service; this is the recommendation of the engine builder; (3) change the oil in the air cleaners every night; this is necessary to keep grit out of the cylinders; (4) change oil filters after 100 hours of service. In two years, as a result of this program, not a set of rings or a connecting rod has been replaced.

One foreman insists that monkey wrenches be kept off the job and says that cast-iron or aluminum pans are far better than light steel pans, which are broken by the vibration from pounding oil. Fuel pumps are changed every 15 months at this mine.

Practices which are fairly uniform include nightly inspection of the fan,

Late-type road maintainer in operation.

Tire care these days takes on added importance.

Sprinkling helps keep roads in good shape.

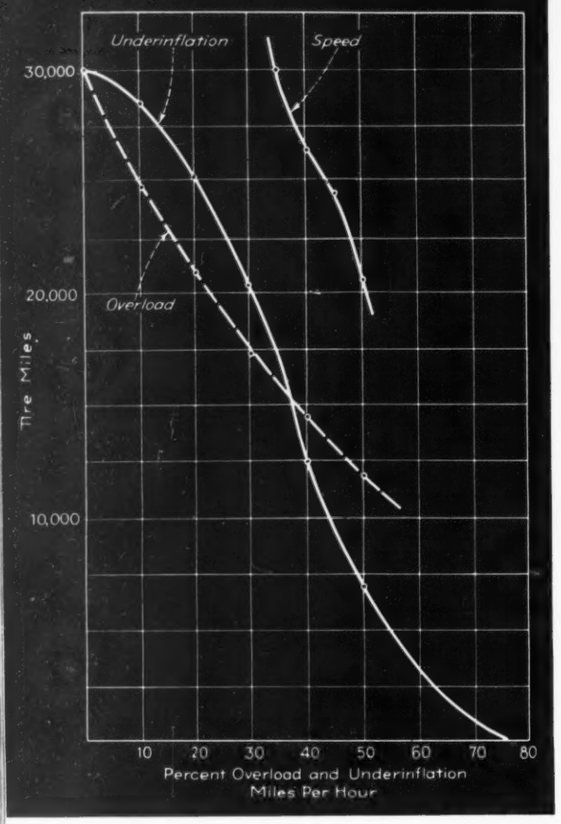


Fig. 1—How certain factors affect tire life.

water pump, fuel pump, air compressor, fan belts, air lines and lubricating devices. Packing wheels every six months also seems to be universal, with bearings and bearing recesses thoroughly washed at each repack. Most mines do not touch wheel bearings in the interim. Various greases are used, including types stated to be resistant to the entrance of splashing water carrying grit. Good results are indicated by the fact that wheel bearings give from three years to indefinite life. One record of three bearings out of 140 replaced in a three- to six-year period seems high, but another man says they never wear out.

Not only rationing but an investment of $3,500 per haulage unit makes the tire problem one requiring the most careful attention. Examination of many discarded tires indicates that they are cut to pieces rather than worn out. Good roads, as has been stated, therefore are an absolute necessity. Perhaps the 75-lb. air pressure used at some mines is correct. One foreman states that reducing pressure from 90 to 70 lb. reduced tire cuts by 75 percent. Another successful superintendent feels, however, that "tire builders know best. Air pressure here is the tire builder's recommendation." Damaged tires normally are shipped to city service stations for reconditioning.

Truck maintenance, as a rule, is carried out in a garage apart from the machine shop. When trucks are used for gathering to rail transfer stations, the garage is in or near the pit. Such parts as require machine work are hauled to the shop. Garage equipment includes an automatic motor-driven air compressor, high-pressure greasing equipment, jacks for changing trailers, means for washing bearings, arc-welders, cutting torches, small drills, grinders, etc. The high-pressure steam cleaners are recent additions. One enterprising foreman has numerous tools, some devised by himself, to service fuel pumps—a very particular job. At another operation, where the new equipment has scarcely reached the maintenance stage, a motor tester is installed to keep engines tuned up. Another organization with years of experience brings its trucks in once a year for complete overhaul, including painting with enamel after sandblasting the surface clean.

Numerous short cuts to lower maintenance have been worked out by the men on the job, and many of them have been adopted by the manufacturers. Examples include:

1. Canopies over air lines to protect them from falling coal.
2. Removal of small air lines from locations under the body to the outside where there is less accumulation of mud and water and consequently less tendency to rust.
3. Wheel hubs with stripped threads redrilled and tapped between the old holes.
4. Wheel hubs bored and bushed when bearing race becomes loose.
5. Piston rods surrounded by boot protection.
6. Guards welded on the body to protect boot from flying mud.
7. Guard welded on spring shackle to protect it from mud deposit (a help in shackle lubrication).
8. Axle redesigned to stop breakage and new axle made from two old ones (Fig. 2).
9. Building up and rethreading end of axle.
10. V-belt driving pulley for engine auxiliaries turned from a material similar to micarta.

Manufacturers of engines, bearings, brakes and other items that enter into the construction of heavy trucks issue elaborate bulletins on the care, inspection, lubrication and repair of these parts. Among the things they stress are:

1. Correct lubricants and fuel.
2. Cleanliness of lubricants, fuel and machine parts.
3. Religious attention to lubrication.
4. Accurate adjustment of bearings and other parts.
5. Daily attention to air filters.
6. Regular attention to oil filters.
7. Cold straightening of heat-treated axles and other parts.

The importance of tire conservation as a war-time measure has resulted in the establishment of a "Tire Conservation Service" by builders. Bus mileages of 60,000 are common, with 100,000 miles "not uncommon," under this service plan, it is asserted. Among the evils frequently uncovered by this service are: 90 percent of the valve caps missing, crooked rims, wrong tire pressure, overloading, mismatched tires and improper tire storage.

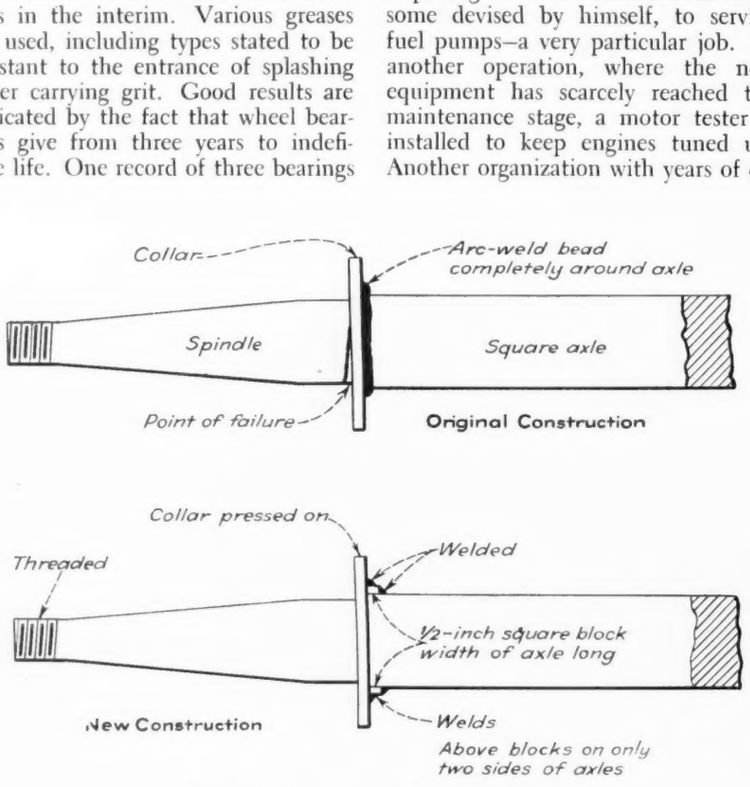


Fig. 2—Axle defect and how it was cured.

PREPARATION PLANTS

Ample Supply and Repair Stocks Essential—Adequate Records Helpful—Regular Inspection Necessary—Welding and Cutting, Reducing Water Acidity and Good Lubrication Also Helpful—New Chute Linings Adopted

PREPARATION plants involve perhaps the widest variety of maintenance problems of any installations around coal mines. In addition to maintaining electrical and mechanical equipment, as discussed in other articles in this issue, preparation-plant operators also are faced with rust, corrosion and abrasion, perhaps the major enemies of preparation equipment and facilities. To combat these latter destructive agents, mining companies have steadily increased their use of corrosion-resisting steels, especially in screens but also in chutes and similar applications.

Special white-metal bottoms in scraper-conveyor lines are other examples of successful attempts to combat corrosion and abrasion. Such metals, however, are getting scarcer and some are unobtainable. Consequently, substitutes are being sought, including concrete, brick and other linings for chutes, tanks and the like. Neutralizing wash water has been adopted by a number of operations to reduce corrosion, and the savings which have resulted are a powerful argument for its extension.

The fact that items ranging all the way from V-belt, chain and gear drives to track, truck and mine-car scales and weigh baskets must be covered exemplifies the scope of preparation-plant maintenance. Daily care is as essential with scales, for example, as with any other mining equipment. They should be set on good foundations, protected from corrosion and all levers should be level and connections plumb throughout. Overloading and excessive shock should be avoided. Testing each lever after repairs is a vital point.

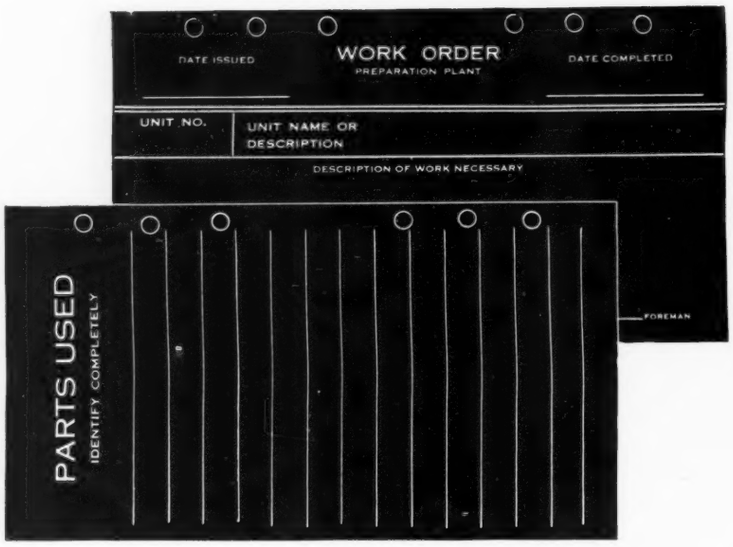
Gears and chains naturally require inspection at regular intervals and should be lubricated in accordance with accepted standards. Many V-belt drives fail because of misapplication or abuse. No less than the minimum sheave diameter should be employed and V-belts should be kept at regulation tightness (all belts in a drive). Guards should be used in dusty places or where oil, grease or water may be encountered. Such guards, however, should be designed with the necessary allowance for belt sag to prevent scuffing. Special synthetic rubber V-belts may be the answer to some conditions. Never pry new belts into the pulley grooves or "ring" them from one groove to the next. Every drive should have a take-up for proper installation of V-belts and adjustment of tension. Sheaves should be smooth and in alignment. If one or two belts are broken, the entire set should be replaced to make sure they all pull their share of the load.

One of the best ways of getting low-cost preparation maintenance is regular, thorough inspection and lubrication. Cleanliness cannot be overemphasized. Coal dust, grease and oil, in addition to making maintenance more difficult, also are definite hazards to life and property. Accumulations must be prevented, and while on the subject it might well be pointed out that no plant should be without ample provisions for fighting all types of fires, including coal dust, grease and electrical. Even "all-steel" plants can be severely damaged by certain types of fires. "Spare the paint and spoil the plant" is a parody on an old adage that might well be taken to heart, also. Where water is used, it follows that special provisions should be made to protect motors, electrical equipment and other facilities subject to moisture damage.

Except for the addition of the specialized equipment, with the accompanying questions peculiar to it, maintenance problems are largely similar in both picking and screening and mechanical-cleaning plants. Other points naturally will occur to men charged with maintenance, but the following attempts to discuss some of the major problems and new developments, especially at washing operations.

"Coal washing is 90 percent main-

Replacing a screen section, one of the commoner maintenance jobs in preparation.



These forms are used to simplify preparation-plant maintenance.

tenance and 10 percent grief," according to one successful operator who has taken his turn at both building and washery operation. There is, perhaps, no exact formula for the design of coal-washing plants which will reduce maintenance to small proportions. Continuous improvement of equipment, changing characteristics of the coal vein, the uncertain corrosive effects of wash water and the fickleness of market demands set aside the possibility of fixed equipment or set operating technique. The whole procedure of washing coal is in a flux that has to be kept up with. These changing factors are reflected in maintenance procedure.

But there are certain well-tested, broad principles that may be relied on to maintain satisfactory equipment conditions and acceptable product quality in all types of plants, both mechanical and otherwise. These may be summed up under six heads:

1. An adequate stock of renewal parts.

2. A system of records that tells the story of difficulties met and overcome, life of equipment and cost of maintenance.

3. Regular inspection at frequent intervals to determine condition of equipment and quality and recovery of product.

4. The necessary tools available at convenient points.

5. A maintenance force immediately following the working shift while ills are fresh in mind, to head off breakdowns and maintain efficiency and quality of product.

6. Reducing the acidity of the wash water (wet plants).

The recommendation of the builder or the prior experience of the man in charge of preparation is the usual basis for determining the original stock of parts for a new plant. At a later date, maintenance records replace the earlier estimate of parts required. Therefore, when all the adverse factors have had an opportunity to develop, actual experience becomes an important index to the probable material required.

In normal times parts could often be obtained overnight. That condition rarely exists today. One supply-room manager discovered several years ago that shipments were so good that the stock was purposely permitted to drop to a low figure to save money. When the war broke out he discovered his stock was not normal at all and was forced to explain to his own officials and to governmental authorities that if coal was to be produced uninterruptedly his stock must be brought up to normal. Other stockroom managers have discovered their stocks are subnormal, too.

One washery with corrosive water to contend with finds it necessary to carry half a dozen pump casings in stock. Others have specific conditions to meet which they must solve without reference to neighboring coal properties. These peculiarities must be learned and supply stocks must be set up to meet them.

There is another phase of maintenance that cannot be overlooked: accidents. The breaking of a bolt, shearing of a rivet, accidental dropping of a bolt or other hard object into gears, breaking of a ball-bearing cage, burning out of a motor, etc., sometimes cannot be predicted, although adequate inspection will head many of them off and past experience will help forecast what may happen. Also, the experience of one's neighbor may indicate what to guard against or be prepared to meet.

Some plants keep elaborate records, but too few is the rule at most. This applies particularly to maintenance. One very simple but adequate record, called a "Work Order," is shown at left. In this plant, every piece of equipment carries a unit number. When filed, these work orders are in numerical order so that all orders applying to a given unit number are in that section. A glance at the file indicates the equipment that has had or needs the most attention.

Work orders are signed by the preparation engineer, master mechanic or foreman. Copies are turned over to

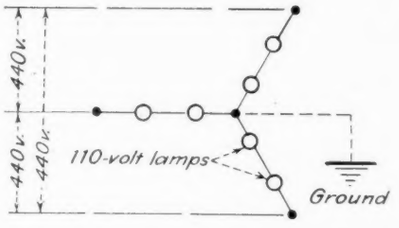


Fig. 1—Simple, low-cost ground detector.

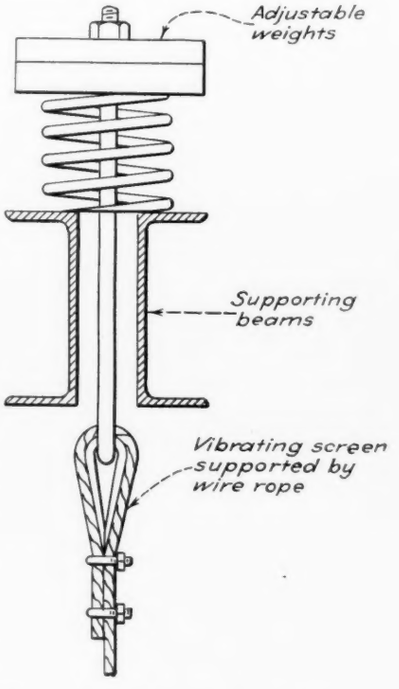


Fig. 2—Dampening spring vibration.

the night foreman in charge of maintenance. These are clipped on a bulletin board with the most important orders at the top. Others are in order of importance down to the bottom of the board. The back of the work order is used to list materials used. The colored copy, of three, goes to the maintenance foreman, who turns it over to the preparation engineer when the job is completed. Filing completes the record. The material used is the basis for notifying the stock clerk in reordering parts.

Individual records are kept for each panel in the dewatering screens at this mine. When they become damaged they are sent to the factory for repair. After another period of use they are carefully examined to determine if they should be returned for a second factory job. Other washeries do their own repairing.

The preparation engineer at this operation personally inspects the plant completely at least once each working day—sometimes twice if conditions seem to require it. Operators report anything they see wrong. Such inspection is a very important procedure, in this engineer's opinion. His attitude is that without maintenance there is no preparation and preperation is the life blood of the business. At other washeries, inspection is handled by the maintenance crew immediately following the operating shift. This is supplemented by reports from operating men and orders from preparation engineers or washery foremen who are in more or less constant touch with plant condition. While any washery is subject to unexpected failure, they rarely are operated until they break down and are stopped indefinitely for repair. The general practice is to keep constantly after them with the idea of preventing failures that stop production.

Tools of the right type at hand when needed are essential for good maintenance. Portable and hand tools come from the shop or from the workman's personal tool chest. They usually are quickly available. Expensive or rarely used tools often are cared for and issued by the supplies manager. In a coal washery there is frequent need for tools that are not so portable.

Electric arc-welding finds daily use within a coal washer. Welding machines are too bulky to be wheeled about to every job. Consequently, there is a growing trend toward equipping washeries with their own welding machines. Frequently the washery building is wired so that all points are conveniently reached by only a short length of welding cable. One washery uses figure 8 trolley wire supported by standard trolley insulators and ears.

Gas cutting is a necessity and gas welding the best means of joining certain metals and repairing certain equipment, in addition to a number of hard-surfacing operations. Some washeries make gas and oxygen tanks a part of their permanent repair equipment —always handy. Others pipe the washery from a central cylinder station and manifold. At some, acetylene generators, housed in their own fireproof buildings or in a lean-to off the washery, take the place of cylinders.

A new tool that is being tried out in some plants is the metallizing gun (see also p. 113). Its possibilities seemingly are extensive. One suggestion is lining pump castings with lead, zinc, hard metals, etc., to ward off corrosion and abrasion. Building up worn conveyor bottoms, chutes, etc., is another, provided sandblasting or other roughening facilities are available.

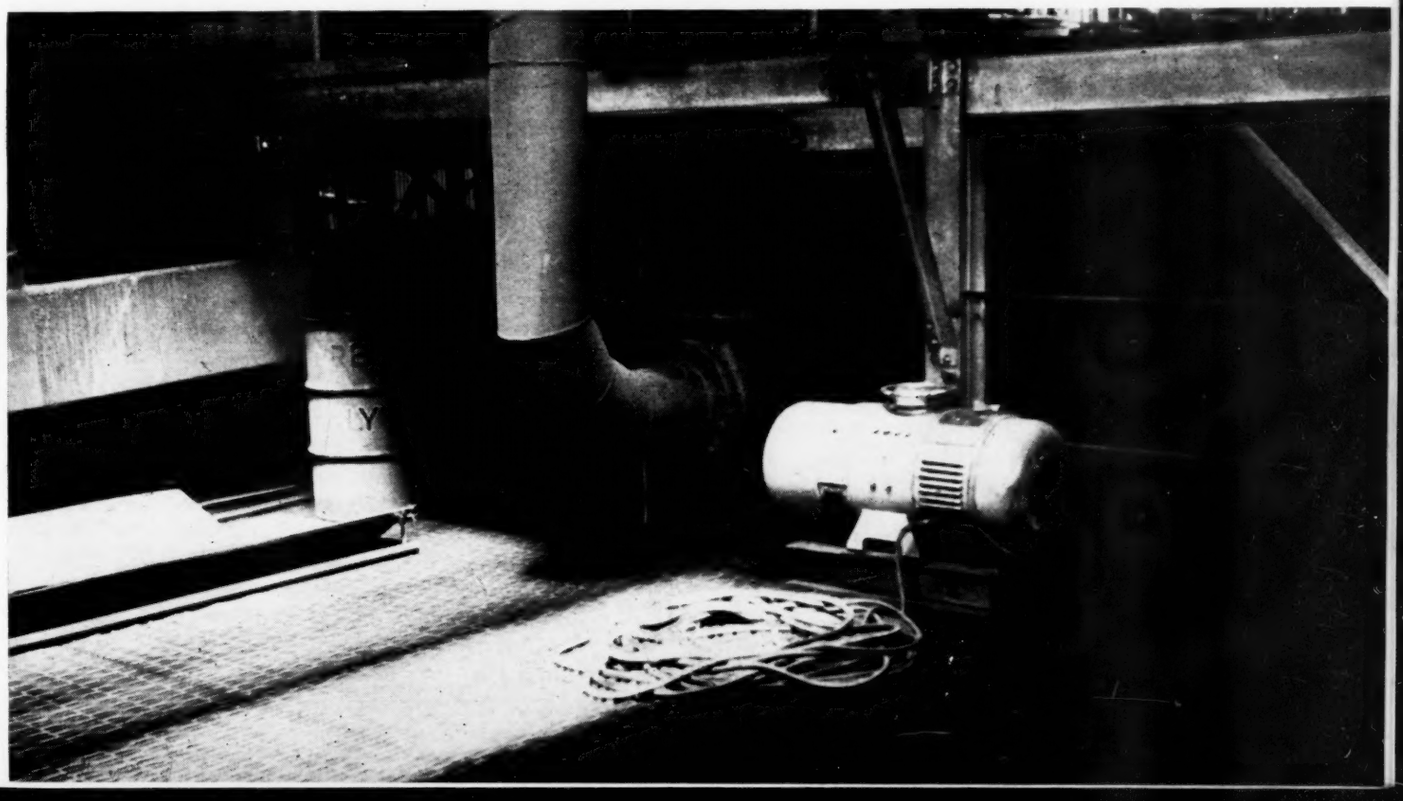
While types of washeries and output rating influences the size and make-up of the maintenance crew at modern washeries, three men and a foreman seem to be sufficient at many plants rated at 600 to 1,000 tons per hour. Two of the men will be mechanics and one a welder.

These men come on immediately after the working shift. In many plants, it is the practice to work the maintenance crew one more shift per week than the plant operates, thus providing time for jobs that cannot be completed in one 7-hour shift. For plants operating three shifts, large-crew week-end maintenance is necessary.

Cleanliness is gradually growing in industry respect. How it is attained depends on conditions about the plant and the ideas of the management. One operation may use men on the working shift. Another leaves clean-up to idle days, while another may delegate it to the men on the maintenance shift. In one large wet washing plant a man is added to the operating crew. In describing his duties it is stated that "he goes over the plant continually with a broom in one hand and a paint brush in the other."

Although practiced by several anthracite plants for years, treatment of wash water to reduce acidity now is being adopted by a growing number of

In line with present-day trends, this welder stays ready for service.



A necessity in preparation-plant operation is regular, thorough lubrication.

bituminous operators. There still seems much to be learned about the causes of corrosion, which seems to be accelerated by dissolved oxygen. Some preparation engineers assert that lime in the fireclay under the coal has a strong neutralizing effect on water and that clay going through with the coal has some beneficial effect. One plant uses 100 lb. of soda ash a day as a neutralizing agent, while another uses hydrated lime. Still another plant was equipped for lime treatment when it was built in 1934, but so far the equipment apparently has not been needed.

Chemists are employed at mines operating washers. Consequently, there is an opportunity to study the problem at close range. Scientific attention to this question should reveal ways of greatly reducing washery maintenance.

Lubrication usually is best handled by having a man or so on duty each shift the plant works. This man may also inspect for equipment condition. A lubrication chart and schedule for each motor and bearing has been found very helpful by a number of operators. Oil companies always are glad to help in preparing such charts.

The electrical department at one mine inspects washery motors and controls each week, making minor repairs as needed. In the event major repairs are necessary it is customary to install substitute equipment until shop work can be completed. Other plants blow out motors once a month with compressed air.

The present-day custom of using circuit breakers instead of fuses for motor protection saves a lot of plant stoppages. Very few failures of these inexpensive air circuit breakers have been reported. A trial usually will show that fuses are a nuisance as well as expensive in the long run.

One washing plant has set a constant watch for grounds in any section of the plant or its equipment. The watchman is an inexpensive and efficient ground detector (Fig. 1). It is made up of six 110-volt lamps wired into the 440-volt plant circuit and is located in the electric shop where it is frequently seen. A ground on any phase is indicated by the lamps on that leg going out or dimming.

Vibrating screens are used by most preparation plants in sizing coal. Many such screens are suspended on steel rods or wire ropes. It was early learned that these suspension devices would soon break if attached to a solid structure. Consequently, spiral springs were introduced to take the shock. Like radio, all moving devices are subject to tuning. Operating men at one large washery found that intensified vibration by tuning could be greatly modified by adding weight on top of the springs (Fig. 2).

To save steel and combat abrasion and corrosion, certain parts in one washery are paved with concrete or hard-burned brick. Flumes carrying coal and the inflow and exit chutes on wash boxes are examples of applications. Experience to date indicates a considerable degree of success.

Line Tank With Gunite

Another operation has adopted guniting as a method of lining the inside of worn steel tanks, troughs and chutes. The first trial was made on a cone-shaped water tank acting as sump for a large centrifugal pump. The flow is some 3,500 g.p.m. of washery recirculating water. This steel tank is approximately 15 ft. in diameter at the top and 15 ft. high.

Aside from the critical scarcity of steel plates and long delivery time, the material alone for this job would have cost $2,500. In five years of service the tank had worn out due to the action of plunging sludge-laden water, and had been repaired about two years ago by welding high-carbon wearing strips on the inside. In addition to the high cost of replacing the tank and the scarcity of steel plates, replacement was further complicated because there was only 23 hours available for work on Sunday from the time the plant shut down until it had to start up again, inasmuch as the property operates three shifts six days a week.

The repair job consisted of scraping clean the inside of the steel cone and spot welding to it, at about 2-ft. intervals, wire-mesh reinforcement (No. 8 wire, 4-in. square mesh). After forming and spotting the wire mesh it was pulled out from the steel as far as possible between welds. Then the gunite was applied in three successive layers to a total thickness of approximately 2½ in.

When the job was completed there was only six hours remaining before the plant had to be started, but as

quick-setting cement was used, the gunite had hardened enough so that it stood up and has shown no noticeable wear in the subsequent eight months.

Subsequent jobs done in the cleaning plant in the short interval available each Sunday include lining a water trough 10 ft. wide by 55 ft. long underneath the dewatering shaker. Another steel trough under a 26-ft.-long by 10-ft.-wide dewatering shaker and a vertical chute 2 ft. square and about 26 ft. tall, through which water and sludge poured to a sludge tank below, also were repaired. These last three jobs have been in service one to two months and likewise show no noticeable wear. The gunite crew and equipment are regularly employed in entry work in the mine and were brought outside for these special jobs.

Inspection at one washery, in which the raw-coal conveyor and all loading booms are fitted with rubber belts, takes in the following:

1. Belts, every four months.
2. Water-supply pumps, every six months. These are torn down and overhauled at the end of that period.
3. High-speed dewatering screens and hanger boards, every night.
4. Slow-operating shaker screens, once a month.
5. Motors, blown out with compressed air, once a month.
6. Electrical system, meggered frequently at the control boxes. This shows up conductor failures in the conduit, which have been known to happen.
7. Loading boom belts, every night in freezing weather. The fact that calcium chloride is used to prevent coal freezing also helps in the washer. Conveyors are started three or four times during the night to see that they run freely.

Some of the things done to reduce maintenance cost, and results obtained, are:

1. The better grades of rubber belting are bought. "A 10 percent cost increase doubles the life of the belt."
2. Belts are respliced once a year whether they seem to need it or not.
3. Belt wear is reduced by self-aligning idlers. According to the men at this plant, this is one of the most important things that can be done for a conveying belt.
4. All the belts in this plant ride on "lubricated-for-life ball bearings." In six years of operation, 230 out of approximately 1,500 bearings have been replaced. All failures were where water could get to the bearings. Present-day bearings have better seals.
5. Belts handling coal are subject to small particles adhering to and building up on the surface. Scrapers often are used to remove this accumulation, but did not prove satisfactory in this plant and a water spray has been substituted.
6. Cuts and small damaged spots on rubber belts are mended with cold-patching material (see article beginning on p. 89 for other repair suggestions).
7. The original segments of the single-roll coal crusher were made of cast iron. The teeth on these segments could not be built up by arc-welding. Substituting cast steel now permits reconstruction of worn teeth.
8. Wash-box screw conveyors are rebuilt once a year.
9. Elevator chains in the wash box last about 2¼ years.
10. Flanges for water piping throughout the plant are made from steel plate and are arc-welded to the pipe.
11. Hydrated lime is used in the wash water to cut down acidity. Piping, it is observed, lasts much longer.
12. This plant has rapidly vibrating dewatering screens. Out of twelve ball bearings on eccentrics, three have failed in almost six years of operation, thus exemplifying their value.
13. When small holes open up in these dewatering screens, they are patched by welding in $\frac{1}{16}$-in. stainless steel rod. When the slot opening wears so wide there is undue loss, the screens are scrapped.

It takes a crew of three men working under the direction of the plant foreman to take care of maintaining this plant today. When it was started, 5½ years ago, but one maintenance man was required. The superintendent points out that "any maintenance program will change with the age of the equipment."

Finish for a maintenance job—shimming up a circulating pump in a washery.

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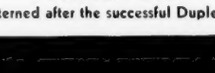

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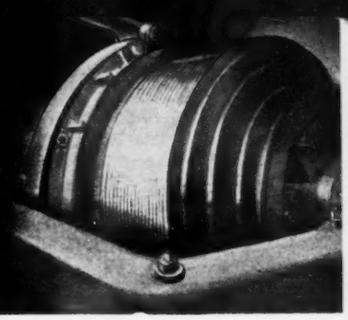
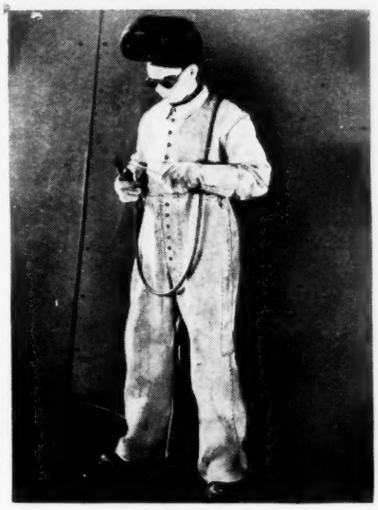
TIPS FROM MANUFACTURERS



Welders' Safety Clothing

To protect welders against painful and dangerous exposure to molten metal sparks, American Optical Co., Southbridge, Mass., offers a completely new and wide assortment of high-grade welders' safety clothing. Including overalls, all-leather pants, hot-weather pants, chaps, split leg apron, one-piece apron, coat, cape sleeves and bib, short jacket, welders' sleeve, spats, gloves and mittens, sleevelets, and various complete protection combinations, the new safety clothing is scientifically built.



Designed by an expert welder of many years' experience, it is made of as few pieces of leather as possible—no unnecessary piecing out, no useless seams. It's constructed to offer maximum protection, fit comfortably, and give long, efficient wear. The clothing is made of the highest grade chrome-tanned cowhide, weighing about 5 oz. per square foot—the heaviest weight that can be satisfactorily used. Most of the garments are cut from Kip splits—the whole hide of the animal. The fire-resisting duck used for backing weighs approximately 12 oz. per square yard. Fleece lining for gloves and mittens weighs about 6 oz. per square yard.

Due to the wide use of Kip splits, AO leathers have very few seams, and these seams, wherever possible, are located well away from the line of fire. All seams are double cotton stitched and reinforced with metal stitching. The coats and cape sleeves have flat seams to prevent irritation and which cause no excessive wear at the elbow. In areas of extra tension and strain, reinforcing rivets provide added strength and longer garment life.

The garments are equipped with large, durable snap fasteners. They're easy to open and close, stand up under hard service, and are generously used to insure tight closures.

Closely spaced rivets reinforce the pants and overalls. To prevent sparks from rolling through, the fly has ample overlap and plenty of snaps placed close together. Catalog picturing and describing the garments may be had from the manufacturer.

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Weld Inspection Chart

An arc-welding inspection chart for use in inspecting welds is offered by the Lincoln Electric Co., Cleveland, Ohio. It presents graphically the different types of welds obtained when the work is done normally, with normal current, voltage and speed, as compared with those obtained when these factors are not normal.

Size and shape of bead, appearance of the bead, undercut, overlap, location of craters are illustrated by enlarged and detailed photographs on the chart. Accompanying the photographs is a table indicating the burn-off of the electrode, penetration of fusion, appearance of bead and sound of arc with each value of current, voltage and speed of welding. The chart is available free of charge to inspectors and others concerned with welding.

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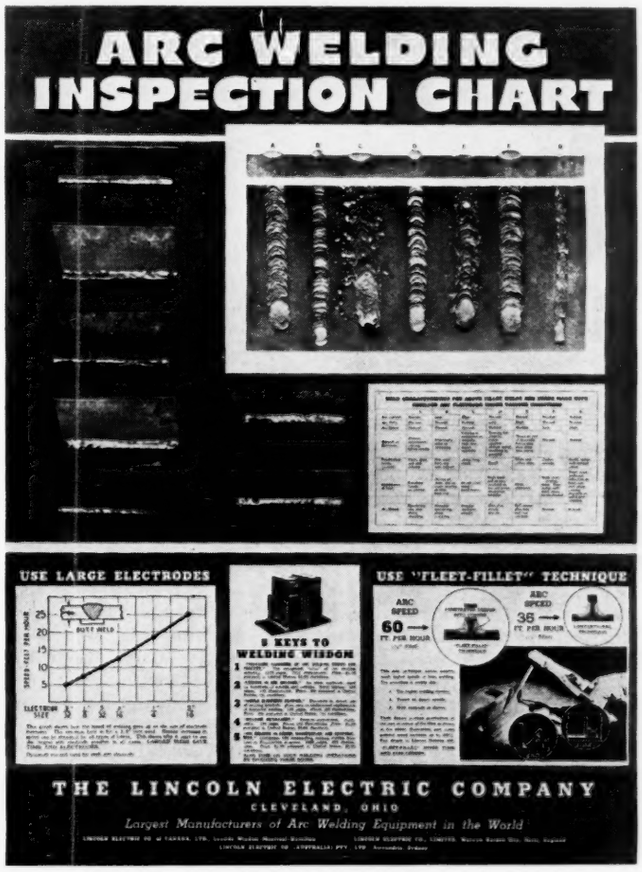
Transformer Cooling System

Allis-Chalmers Mfg. Co., Milwaukee, Wis., announces a new system of forced-oil cooling that is said to save 25 percent in critical war materials on new transformers. The new cooling unit, called the "Electro-Cooler," will step up capacity of transformers already in service by about 20 to 60 percent, the company reports. If the transformer has radiator valves, the unit can be removed without draining the transformer oil, and parts can be replaced without delay in transformer operation.

The "Electro-Cooler" consists of a radiator-type cooler and a special pump with motor inclosed. These are connected by piping to the standard radiator valves at the side of the transformer. No stuf-



fing boxes are required in the special pump, and the motor is self-cooled and self-lubricated. Because the new cooling unit is relatively small, usually more than one is required, the number depending upon the size of the transformer. Greater reliability can be expected from the multiple units, since operation of one is not dependent upon the other.

For the current emergency, it can not only be built into new transformers but can be readily applied to transformers already in service, subject to the recommendations of the transformer manufacturer. If the transformers are equipped with the conventional type radiator valves, installation can be made in three to four hours without even removing the oil in the transformer.

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Arc-Welding Electrode

A new arc-welding electrode, designed to add still more speed to arc welding in war production, is announced by the Lincoln Electric Co., Cleveland, Ohio. Designated as "Fleetweld 11," the new electrode is created expressly for use with the "Fleet-Fillet" technique of arc welding. It gives deep penetration of metal into the root of the joint. It is of shielded-arc type and heavily coated to exclude oxides and nitrides from the weld, thus assuring the high quality of weld metal characteristic of the shielded-arc process. High currents are used, the electrode is advanced at a high speed and the weld metal penetrates into the corners where the two pieces of metal are joined. The electrode is held at an angle of 45 to 60 deg. with the horizontal plate and 90 deg. with the electrode path along the joint. The arc produced is so short, the electrode coating practically touches the metal.

Designed to complete a weld in one pass, "Fleetweld 11" is made in 18-in. lengths and two diameters, $\frac{3}{16}$-in. and 14-in., packed in 50-lb. cans.

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Buna S Conveyor Belt

Hewitt Rubber Corp., Buffalo, N. Y., has completed the manufacture of an all-synthetic rubber conveyor belt which is believed to be the first of its kind made from Buna S synthetic rubber, without the addition of natural rubber or reclaimed rubber. Buna S, made by a chemical combination of butadiene and styrene, is the general-purpose synthetic rubber for which our government is building plants to produce 700,000 lb. per year.

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New Tool Bit

A new line of tool bits for machining hard, tough steels and other copper or aluminum alloys is offered by the Black Drill Co., Cleveland, Ohio.

These "Hardsteel" tool bits are designed to fit into the present war production program wherever lathes, boring mills, shapers and planers with tool lifters work on hard or tough steels, such as the 4100 series, the high-chrome, high-nickel and high-speed tool steels. They also may be used on abrasive copper, brass, bronze and aluminum alloys, either rolled or cast; said to be especially suited for work on heavy forgings where deep rough cuts can be made at fast cutting speeds, but at the same time give excellent results when used as finishing or forming tools.

These tool bits can be reground on an ordinary wheel time after time, it is said, but, because they take abuse and operate efficiently at red heat, they do not need frequent regrinding.

"Hardsteel" tool bits are made square and round from $\frac{1}{8}$ in. up in all the usual sizes.

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Metal Etcher

Ideal Commutator Dresser Co., Sycamore, Ill., offers a new electric etcher that permanently marks anything made of steel, iron or their alloys. To etch small tools and parts it is necessary only to place them on the work plate, turn the switch "on" to proper heat and start writing. A ground clamp conveniently attached to the work plate is provided for etching large, heavy parts and castings.

"Hi-Lo" taps and a seven-point switch give 14 etching heats between 115 and 1300 watts. A red lamp on front of etcher indicates when power is on and burns brighter as each higher heat is used. Depth of mark also can be controlled by speed of writing.

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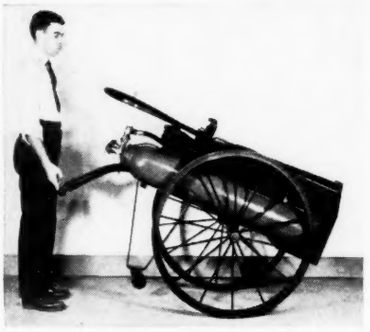
Fire Extinguisher

American-LaFrance-Foamite Corporation, Elmira, N. Y., announces the Alfite carbon dioxide engine, a 100-lb. unit approved by Underwriters' and Associated Factory Mutual Laboratories for use on both electrical and oil fires. Equipped with an Anti-Statik horn to protect the operator from static charge, it is designed for perfect balance at wheeling height, has a third swivel wheel for easy maneuvering, and a retaining latch which releases horn instantly, yet holds it firmly in place when not in use.

It is recommended for fires in flammable liquids, alcohol storage, electrical machinery, and for other class "B" and "C" fires. It is said to smother fire instantly with carbon dioxide gas, which expands upon discharge to 450 times its stored volume; is non-corrosive, non-poisonous, odorless.



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New Hydraulic Vise

Studebaker Machine Co., Chicago, offers the new Drilvise, an automatic vise for drill-press work and many other operations. It is hydraulic and entirely foot-controlled, leaving the operator's hands wholly free for the work.

By foot-operated levers Drilvise is said to give any holding grip from contact to more than 10,000 lb. Foot-pressure moves the rear jaw forward $\frac{3}{16}$ in. at a time until the required grip is obtained. It handles all work, heaviest to lightest, with safety and precision. Bulletin may be obtained by addressing the manufacturer at 9 South Clinton St., Chicago.

•

Electric Cap-Lamp Care Promotes War Effort

"As coal and metal mining are recognized as essential to the war effort it is imperative that every phase of mine operation be conducted in a manner to permit maximum efficiency," states R. M. Lambie, president, Wheat Lamp Sales Co., Charleston, W. Va. "The importance of mine lighting cannot be discounted, for only well-lighted mines can be operated safely, efficiently and economically. The approved electric cap lamp is, therefore, an asset. It is designed to provide maximum safety. It provides a properly diffused and continuous light throughout the working shift, enabling the wearer to observe all conditions in his working area and to detect dangerous conditions. It also enables him, if he is a miner, to see impurities in the coal. It is economical because it costs very little per shift and does not require time out for lamp filling.

"Practically all materials used in the manufacture and maintenance of approved electric lamps are classified as critical and needed for our war purposes. Any abuse, neglect or lack of care in the lamphouse, or by the user of the lamp, is a form of sabotage which will be detrimental to our war effort. To assure complete utilization no lamp or lamp part should be scrapped and all worn or damaged parts should be properly stored or carefully packed and returned to the manufacturer.

"The lampman should check all lamps at regular intervals to determine whether or not they are getting the proper charge. He should be careful not to overwater. The

Exide
IRONCLAD BATTERIES

THE more we save, the more we'll have. That's most important today. Wasteful buying, and wasteful misuse of equipment, are *out* for good.

Remember this, when caring for your dependable, long-lived Exide Batteries. Follow the simple rules printed on this page, follow them faithfully . . . and you're really working for America. Take care of your equipment, and help a lot of fighting Yanks take care of the Axis.

YOUR SCRAP will help WIN

AND HERE'S OUR PRESCRIPTION FOR BATTERY CARE!

1. Keep adding approved water at regular intervals. Most local water is safe. Ask us if yours is safe.
2. Keep the top of the battery and battery container clean and dry at all times. This will assure maximum protection of the inner parts.
3. Keep the battery fully charged—but avoid excessive over-charge. A storage battery will last longer when charged at its proper voltage.
4. Record water additions, voltage and gravity readings. Don't trust your memory. Write down a complete record of your battery's life history. Compare readings.

If you wish more detailed information, or have a special battery problem, don't hesitate to write to Exide. We want you to get the long-life built into every Exide Battery. Ask for booklet Form 1982.

THE ELECTRIC STORAGE BATTERY CO., Philadelphia
The World's Largest Manufacturers of Storage Batteries for Every Purpose
Exide Batteries of Canada, Limited, Toronto

mine superintendent can be of great help in maintaining good lighting if he will check his lamphouse equipment regularly with the lampman and also see that all surplus lamps are cycled once each week to keep them in proper working condition and ready for use, and also to avoid deterioration.

"In view of the many men being selected for military service, those who are not called must produce to the limit of their efficiency, for unless all of those employed underground give their utmost we will not obtain the high tonnage required to keep the manufacturing industries going to capacity. We, as lamp manufacturers, can assure you that our efforts will be untiringly devoted to the maintenance of good mine lighting and ask that you cooperate with us so that when the war is over we may know that we contributed fully to the cause of victory."

Longer Tire Life Can Be Secured By Attention to Rules

ORIGINALLY devised to extend the lives of highway type tires now in use, the Goodyear Tire & Rubber Co.'s truck tire engineering service also is being used to reduce operating costs on large tires for off-the-road service, officials declare. On the premise that care and attention determine whether the operating cost per tire will be high or low, Goodyear research engineers set up a group of principles which, they state, can materially lower each tire's operating cost. These principles are:

1. Maintain proper inflation. This item is of major importance. Tire inflation is the one item that is entirely in the hands of the operator. Give tires, Goodyear engineers advise, the same attention that is given greasing jobs, for instance. Use of Tire & Rim Association specifications for air pressures is recommended.

2. Keep valve caps on the tubes. The Goodyear engineers point out that the valve cap performs two functions. It keeps dirt from reaching the main valve seat and it forms a secondary air seal over the end of the valve. A great many slow leaks can be eliminated by constant use of valve caps. Keep a supply of valve cores on hand, it is recommended, and replace old ones when they first develop a slow leak.

3. Inspect tires regularly and remove all foreign materials. Repair snags and cuts before they develop into major repairs. Keep haulage roads in good condition. Clean up around the shovel and, at large operations, have a man patrolling the road at all times.

4. Make regular checks of front wheel alignment, axles (for bending), spring frames, shifted or broken springs and similar items.

5. Apply new tires in pairs on dual wheels and keep tires evenly mated by actual over-all diameter. It usually is possible to put odd tires on single fronts or on other single-tired wheels. Tandem grader wheels should be mounted with allowances for differences in rolling radii. If a new tire must be mounted with three old ones, Goodyear engineers advise, add 5 lb. extra pressure to the old ones and run the new tire 10 lb. under the normal specification for that tire.

6. All rims should be cleaned with a wire brush before applying the tires. Goodyear engineers warn against use of oil or grease on rims, saying that graphite mixed with glycerine or water is the best rim dressing. Where tire beads are stiff and hard to slip on rims, a solution of soapy water is suggested as the best lubricant. Bent rim flanges should be straightened to give the bead full support.

7. Don't use old flaps or tubes with wrinkles in them. When tires are being mounted, all foreign materials should be cleaned from the inside. To raise a large tire to the proper height for mounting on non-removable rims use a sling or cradle of rope or old belting. Don't use chains or cables which will cut in around the bead area.

8. At the end of each three working shifts check the air pressure with an accurate gauge. Add air when the level has dropped 5 lb. in heavy tires (3 lb. on passenger tires). Do not reinflate if excessive losses of air occur. Above all, Goodyear engineers emphasize, don't continue to reinflate tires which show signs of leakage or damage. Find the cause of the leakage and correct it.

9. Keep pressures in dual tires equal, as well as pressures on both sides of the axle, as over-inflation or uneven dual inflation will cause serious trouble.

10. Don't operate tires until they blow out as a result of injuries. This is uneconomical in dollars and cents and wasteful of vitally needed rubber. All injuries which extend into the cord body of a tire should be repaired immediately to prevent inflows of dirt and water.

11. Do not put a boot in a casing that is worth repairing because a boot is intended to be used merely to get a few more days' service out of a tire not worth repairing. Likewise, don't attempt to use cold patches for repairs on large-size tubes. Install a tube vulcanizer or send the tubes to a good repairman.

12. Knock out rocks or wood between duals as these will cause failures which are seldom repairable. Clean mud and dirt from around the exposed valves periodically and keep oil from tires as much as possible as it causes rapid deterioration.

13. Do not mount as duals if there is a difference of more than ½ in. in diameter. The larger of two new tires should go on in the same position as the larger of two old ones. In addition, it is essential that duals have correct spacing.

14. For servicing tires on off-the-road projects, provide a portable service station on a truck or trailer, including in its equipment pumps for lubrication of all kinds, light generating plant, tire spreader, air compressor, airline connections and repair parts for valves.

Good Commutation Requires Proper Brush Choice

Continuing his series of brush talks, A. A. Stark, chief engineer, Ohio Carbon Co., offers some comments on the subject of commutation, as follows:

"*Factors Governing Good Commutation*—Good commutation in any d.c. machine is dependent upon a number of factors linked to one another, the primary requirement being the proper contact drop at the brush face. Considering any one grade of brush material, the contact drop varies with the electrical characteristics of the armature, with the surface speed, with the pressure, with the current density and with the atmospheric conditions. To choose the material that will give good commutation—in other words, maintain the proper contact drop—it is necessary for the application engineer to have not only the specifications of the motor in question but data as to the service or duty this motor is required to perform and also its location relative to unusual conditions.

"*Contact Drop as Related to Brush Grades*—All brush materials will have the same contact drop somewhere within their normal operating range, although in a few cases this drop will occur under conditions that are not met with in operation. The point is that one grade of material may have to run at a very low surface speed and high current density and another at a very high surface speed and perhaps either high or low current density to bring the end result to a given contact drop. In other words, given the problem of operating all brush materials at a specified contact drop, then it is necessary to vary the current density, the pressure and the surface speed to accommodate the characteristics of each of the materials."

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Indicators for Hot Spots Guard Storage Coal

"Soft coal, when first stored, tends to 'weather,' with spontaneous heating that may accelerate as much as 2 deg. F. a day," points out the Coal Specialties Co., New York City, in calling attention to the use of indicators to signal a temperature rise. "This rate is believed to double for each 10 deg. rise in outside temperature, coal stored during the summer being much more liable to spontaneous combustion. But as long as the coal temperature does not reach 150 deg. F., no danger exists. Safe weathering temperatures as high as 140 deg. F. have been known. Yet never has it been found that the temperature receded after 150 deg. was reached; 150 deg. represents the critical point, from which the temperature may be expected to rise to the ignition point within 72 hours.

"The 'Hot Spot' indicator consists of a 15-ft. steel casing capped at the top and threaded at the bottom for a fluted bronze tip for thrusting into the coal. Inside the casing is a chain of seven fusible links spaced 2 ft. apart and held under tension by a strong spring. Each patented fuse 'blows' at 150 deg. When a link so parts, the tension breaks and another powerful

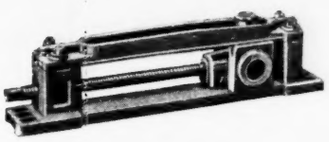
MORROW MAINTENANCE PARTS

KEEP VITAL COAL SUPPLY *Flowing* TO WAR PRODUCTION AND ESSENTIAL INDUSTRIES . . .

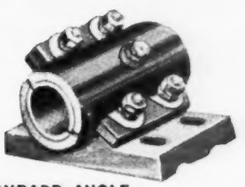
Today's all-out war effort requires considerably more than ordinary care of hard-to-replace equipment and parts. Proper maintenance is most important during these days of three-shift production. MORROW, with a background of over 25 years' experience in designing, producing and maintaining dependable coal handling equipment, can definitely help you keep your equipment at peak operating efficiency.

Typical Key Parts—Readily Obtainable . . . Your Orders Given Prompt Attention!

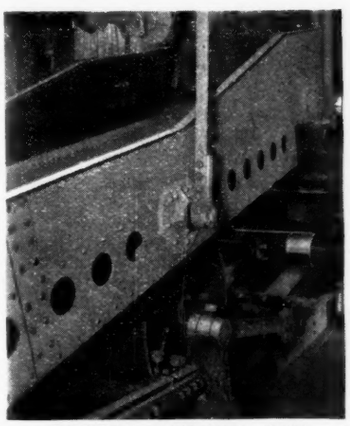
APRON CONVEYOR PARTS
chain links, steel apron flights



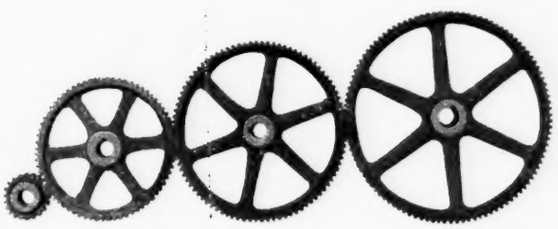
STANDARD TAKE-UP BEARINGS



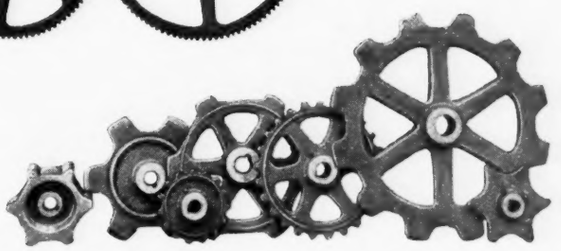
STANDARD ANGLE BEARINGS



STANDARD SCREENING UNIT PARTS including rocker arms, pins, connecting rods, screen side bearings, screen hangers, etc.



GEARS



SPROCKET WHEELS

MORROW

MANUFACTURING CO. WELLSTON, OHIO

DESIGNERS AND BUILDERS OF COAL HANDLING EQUIPMENT FOR OVER 25 YEARS

COMPLETE COAL TIPPLES AND COAL HANDLING EQUIPMENT

Elevating and Conveying Machinery

Sand and Gravel Screening and Washing Machinery

Shaking Screens

Coal Washers

Car Hauls, Picking Tables

Loading Booms, Loading Chutes

Bins, Bin Gates

Car Retarders

Settling Tank, Grizzlies

Revolving Screens

Perforated Metal Screens

Flanged Lip Screen Plates

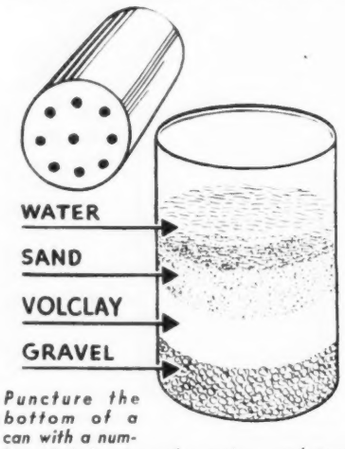
Do You Mine More Water Than Coal? • • •

If your drainage problem is a headache and expense, maybe VOLCLAY can help you.

VOLCLAY has been used successfully in many mines and, in the words of one prominent mining engineer, "We have, for practical purposes, stopped the flow of water . . . our experience was a revelation in that it (VOLCLAY) was easy to pump, did not cut the valves or pump lining, and on coming back through fissures and seams, would close them up—much quicker than we had been able to do heretofore with cement grout."

VOLCLAY is a natural clay which has the astonishing property of being able to absorb many times its weight of water and to SWELL ENORMOUSLY in the process. It never permanently sets or hardens so that it provides a perfect seal for any source of seepage, leakage, or constant flow of water.

Let us send you a FREE sample and try this simple test yourself



Puncture the bottom of a can with a number of holes to make a sieve and cover the bottom with an inch of gravel or coarse sand. Water will flow through freely. Now cover the sand or gravel with ½-inch of KWK VOLCLAY and put a layer of sand over it. Fill with water. It will not penetrate.

VOLCLAY, properly placed in the path of water, always stops it.

Send us the details of your own water problem and get our engineer's recommended method for using VOLCLAY.

AMERICAN COLLOID CO.
363 W. SUPERIOR ST. CHICAGO

spring forces up a plunger carrying the top cap, giving a signal visible 300 ft. away.

"Each indicator simultaneously watches temperatures within a horizontal radius of 10 ft. at seven different levels. Since dangerous heating generally develops between 2 and 10 ft. from the surface, and seldom deeper than 10 ft., these indicators, when spaced not farther than 20 ft. apart, afford positive protection against spontaneous combustion developing without notice in any part of the coal pile."

Excavators Do More and Last Longer When Regularly Oiled and Checked

REGULAR inspection enables excavating equipment to do more and last longer, declares the Link-Belt *Speeder News* in the second of a series of articles published in the interest of conserving America's machinery for sustained war effort. Reprints of both articles will be supplied upon request, Link-Belt states.

"In many cases, 'continuous production' means 24 hours a day seven days a week, with three different crews running each machine. Unless a definite daily inspection schedule is set up and rigorously adhered to, there's bound to be trouble sooner or later. It used to be a game to leave inspection and servicing to the next shift. Those were the days of 'everybody's responsibility was nobody's responsibility' and nobody seemed to care—much. But those days are gone or we may be goners. . . .

"No machine operating on an important job should be without its oiler. His important functions are:

"1. Keep machine lubricated with grades of oil and grease and at the intervals specified on the lubrication chart. (Don't use more lubricant than necessary. Too much grease in anti-friction bearings is harmful.)

"2. Wipe up excess oil and grease—keep it out of clutches.

"3. Check oil level in crankcase and fuel tank and water level in radiator.

"4. Keep machine clean. A clean machine is far easier to maintain than a dirty one.

"5. Check all bolts and nuts for tightness while going over the machine for greasing.

"Where machines are running more than a single shift—and most of them are today—enough time should be allowed each operator to make a careful check up at the beginning of each shift. This should include the control system, engine, all clutches and brakes, crowd and travel chains. He should check bearings for indications of heating and see that the oiler is doing his job. A good operator is more than just a lever puller. He knows every detail of his machine, how to adjust it and make repairs if necessary, and he is responsible for care as well as operation while on duty.

"On many large jobs, where much equipment is used, repair work is done by a separate crew under the supervision of a master mechanic in charge. Such a set-up does not relieve the operator of the responsibility to see that his machine is properly maintained, and he should report immediately anything requiring attention, keeping after it until the work is done. The man who demonstrates his interest in the care and operation of his own machine is the one who is picked for the supervisory job.

"As no two jobs are exactly alike it is hard to set any hard-and-fast rules as to intervals between inspections. However, better too often than not enough. Establish a definite schedule of inspections and adjustments and follow it. As a suggestion:

"*Lubrication*—Follow lubrication chart.

"*Treads*—Depends upon amount of traveling, but recommend once a week.

"*Propelling Chains*—Depends upon amount of traveling, but recommend once a week.

"*Steer and Holding Brakes*—When any indication of slipping.

"*Clutches and Brakes*—Every shift.

"*Hydraulic Control System*—Every shift.

"*Crowd Chains*—Weekly.

"*Saddle-Block Adjustments*—Weekly.

"*Oil Level in Engine Crankcase*—Every shift.

"*Water Level in Radiator*—Every shift. (In cold weather, check strength of anti-freeze.)

"*Oil Level in Fuel Tank*—Every shift.

"*Engine Clutch*—Weekly.

"*Engine Drive Chain*—Monthly.

"*Bolts and Nuts*—When oiling.

"*Cables*—Daily.

"Engines and Accessories—Follow directions in engine manufacturer's instruction book.

"*Lighting Plant*—Follow directions in manufacturer's instruction book."

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Production-Boosting Posters

Bressler Editorial Cartoons, Inc., New York City, offers a weekly cartoon service featuring a new type of boost-production poster that talks directly to hundreds of thousands of workers with the heightened impact of color.

One poster cartoon depicts two cowering apes with the distorted features of Hitler and Hirohito, horror-struck at a sky swarming with American bombers. The bold lettering beneath shouts, "Here's Your PLANE WARNING!" To heighten the average worker's respect for his job there is a poster showing a keen, purposeful citizen rolling back his sleeves. His face shows grim determination; his zeal is that of a crusader. In the distance big guns hurl steel at the enemy. And, as if actually participating in democracy's crucial battle, the worker shouts, "I'm a Fightin' Man Too! WATCH MY SMOKE!" The family angle is brought into play with a small group saluting the tight-lipped giant vision of Uncle Sam with: "We're All in the Army Now—Let's All Work to Win!"

Industrial Notes

MINNEAPOLIS-HONEYWELL REGULATOR Co., Minneapolis, Minn., received the first joint Army-Navy Production Award in the Chicago Ordnance District, presented by Brig.-Gen. Donald Armstrong, chief of the Chicago Ordnance District, at an impressive ceremony Aug. 18, which was witnessed by more than 4,000 employees and guests.

INDEPENDENT PNEUMATIC TOOL Co., Chicago, announces new locations of its branch offices in Boston, Mass., and Birmingham, Ala., and the appointment of a new Boston branch manager. The Boston office, now managed by Vance G. Turner, has moved to 78 Brookline Ave., and the Birmingham office has moved into its new, modern home at 1411 North Third Ave.

WORTHINGTON PUMP & MACHINERY CORPORATION, Harrison, N. J., has appointed R. J. Laidlaw as manager of its Cleveland district office. He will succeed A. J. Klug, who will now devote his entire time to special work with certain important industries in the Cleveland district. Mr. Laidlaw has been with the Worthington organization since 1919.

WALTER L. MAXON has been appointed manager of Allis-Chalmers Mfg. Co.'s crushing, cement and mining-machinery department, Milwaukee, Wis. He succeeds Herman Schifflin, who is retiring. Before joining Allis-Chalmers in 1927 Mr. Maxon was a professor of metallurgy at the Colorado School of Mines and also served as a consulting engineer for various mining and metallurgical interests. In 1940 he became sales manager and chief engineer of the A-C Mining-Machinery division.

BERT DINGLEY, of automobile racing fame in the days of the old barn-storming road races, and later associated with such pioneer manufacturers as Marmon and Stutz, is now president of the Marmon-Herrington Co., Inc., Indianapolis, Ind.

A SERVICE FLAG for the 1,792 Johns-Manville men now serving in the armed forces of the United Nations was dedicated by Lewis H. Brown, president of Johns-Manville Corporation, at a ceremony held Aug. 24 in New York. Sponsored by the J-M Women's Defense Workshop, an organization of Johns-Manville women formed as a voluntary service group to assist men who have left the company for the Army and Navy, Miss Augusta Cingolani, co-chairman of the workshop, presided at the ceremony.

WHEELER INSTRUMENT Co., Chicago, announces three appointments to the company's sales and service organization. C. L. Clark, of Westinghouse Electric & Mfg. Co. for the past 13 years—recently as control specialist at the Cincinnati office—has been attached to the Cleveland office as sales engineer. Robert N. Miller,

GIFT TO HERR GOERING

Yes, it makes the job easier for the Reichmarshall's Luftwaffe every time you kink a mine cable. So, make your Electric Cables last longer, follow these simple rules:—

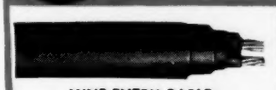
Avoid pulling kinks into the cable...straighten before dragging and while unreeling. Take time to lift and pull over rough places. Don't drag through or allow cable to lie in mine-water puddles. Never let a car wheel or other heavy object run over the cable. Dry thoroughly before reeling up. Effect minor repairs promptly before they become serious.

JOHN A. ROEBLING'S SONS COMPANY
TRENTON, NEW JERSEY
Branches and Warehouses in Principal Cities

IRON AND STEEL ARE DESPERATELY NEEDED! Throw Your Scrap into the FIGHT!

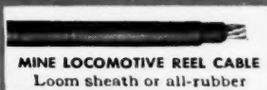
JAR ROEBLING

ROEBLING MINE WIRES AND CABLES HAVE ENLISTED FOR THE DURATION!



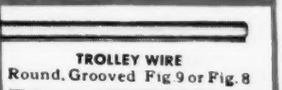
MINE ENTRY CABLE
Non-metallic—Rubber

MINING MACHINE CABLE
Loom sheath or all-rubber

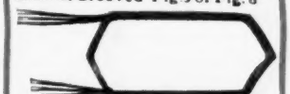


MINE LOCOMOTIVE REEL CABLE
Loom sheath or all-rubber

BORE HOLE CABLE
Rubber or Varnished Cambric Round Wire Armor



TROLLEY WIRE
Round, Grooved Fig 9 or Fig. 8

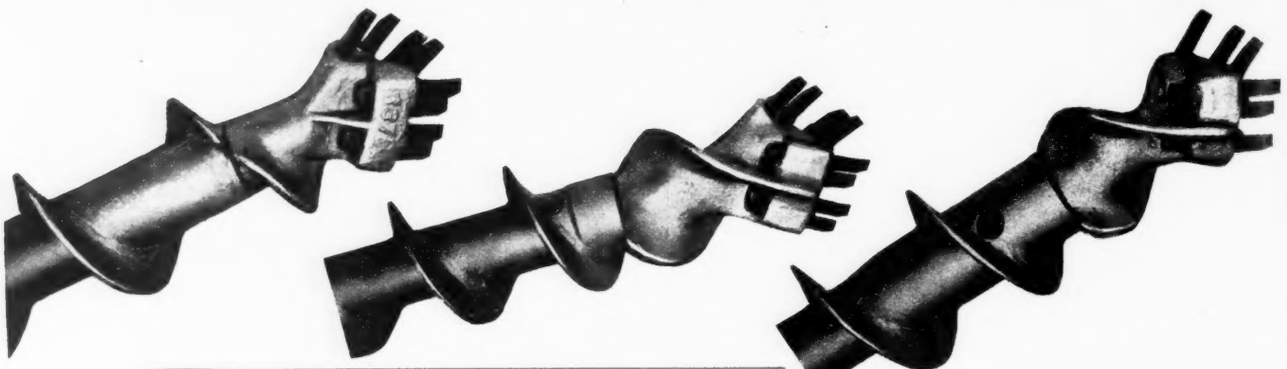


ARMATURE AND FIELD COILS
For Motor Repair

★ ★ ★ PROMPT SHIPMENT TO MEET ESSENTIAL NEEDS ★ ★ ★

ROEBLING
ELECTRIC WIRES AND CABLES

Helpful HINTS ON USING AND



STRIP MINING

1. Augers

(a) Here the couplings definitely outlast the spirals unless hardsurfaced: so purchase your auger requirements hardsurfaced and *maintain* the hardsurfacing by building it up as it wears.

(b) If your spirals get bent over or broken up on rocks or your auger bent or broken do not discard it if it is otherwise serviceable. Send it in to us for repair. If your auger is not worthwhile repairing we will tell you so.

(c) If you now and then lose an auger in the hole, buy a *fishing tool*. We make tools that will help you fish these augers out. Investigate!

(d) Save your old augers. They are made of an alloy tubing that is high on the critical list. Even if they are not economically repairable now, before the war is over these same augers reconditioned at no saving may be worth more to you than the new auger we would have to make for you out of substitute materials. So hang on to your worn out Coalmaster augers. They are really worth far more to you than you think.

2. Drill Heads

Head life can be prolonged by building up our hardsurfacing as it wears away. Where this is done around the bit sockets, first bit up the socket lightly and preheat and cool slowly to avoid cracking. For best results and longer head life, do your maintenance *before* the socket walls are allowed to wear thin.

3. Bits

(a) When bits get dull, *change them*. This will actually speed up your production and very materially increase the service life of your tools and decrease their maintenance.

(b) You can cut your bit cost by not throwing away bits that still have service in them. Put your new bits in the O.D. positions and use up your half worn ones in the I.D. or intermediate positions.

(c) Don't wear the bits so short that they do not cut clearance for your auger spirals.

● **Mr. Operator: Install all the points of economy mentioned on these two pages. Use our representatives. They are drilling specialists —all anxious to serve you. Consult with them about use and maintenance; consult with them about any drilling problem. If they don't know, they can probably find out for you.**

MAINTAINING Your

COALMASTER

BLAST HOLE DRILLING

TOOLS

UNDERGROUND

MINING

1. Augers

(a) Purchase your sectional augers hardsurfaced. If the couplings outlast the hardsurfacing job, hardsurface them again in your shop.

(b) If an auger is otherwise serviceable, except for a worn shank or socket, these repair parts are available in all sizes for replacement purposes. Maybe a 9' can be made up into a good 6' or 3' by just replacing one end.

(c) Save your old augers if they are built on 1⅛" tubes or larger. These are alloy tubes that are high on the critical list. Even if they are not economically repairable now, before the war is over these same augers reconditioned at no saving may be worth more to you than the new auger we would have to make for you out of substitute materials.

2. Drill Heads

Head life can be prolonged by building up our hardsurfacing as it wears away.

● **Coalmaster drill heads are designed to drill with a minimum of power. This feature offers the opportunity to do a better and faster drilling job without increasing the load on the drilling machine. Just one of the reasons why so many mines prefer Coalmaster.**

Coalmaster Matched Tools are available for holes from 1½" to 16" diameter.

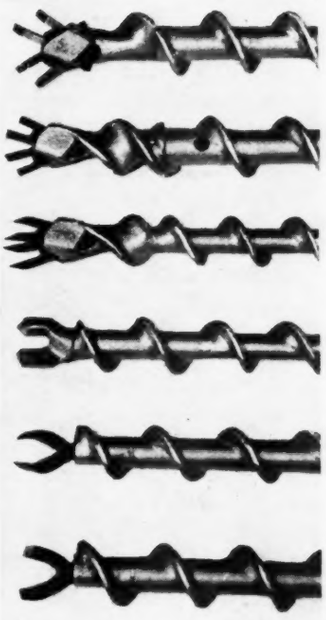
3. Bits

(a) When bits get dull, *change them.* This will actually speed up your production and very materially increase the service life of your tools and decrease their maintenance.

(b) You can cut your bit cost by not throwing away bits that still have service in them. Put your new bits in the O.D. positions and use up your half worn ones in the I.D. positions.

(c) *Tighten up* on your plan of bit distribution to *control* waste. *Insist* on your worn bits being turned in to the person who issues new ones. If inspection shows that the bits are being returned without being *reasonably dulled,* get tough about distributing new ones. It will not delay your production nor will it overload your drill to wear the bits *reasonably* dull, but don't pinch *too* tight on this for the driller's primary job is to get you hole production.

Keep these worn bits that are returned. Pick them over carefully before selling them for scrap. The scrap campaign does not want material that can be economically used in its present state. Make your worn bit pile your second line of supplies to fall back on.



CENTRAL MINE EQUIPMENT CO.

ST. LOUIS, MO.

"The Drill Bit People"

25 Years of Progress

BITUMINOUS CASUALTY CORP. 1917 25th ANNIVERSARY 1942

FOR 25 YEARS the Bituminous Casualty Corporation has grown and expanded, until today it is one of the largest agency companies in America specializing in Workmen's Compensation, Public Liability and Property Damage coverages.

Assets now exceed $9,300,000.00 and reinsurance of $1,000,000.00 in excess of $20,000.00 compensation, and our safety engineering and claim services are second to none.

Bituminous Casualty operates in 20 states and has claim offices in each one of them for better claim service to policyholders.

We would like to tell you more about it — Investigate today — a postal card will do the trick.

BITUMINOUS CASUALTY CORPORATION

ROCK ISLAND ILLINOIS

for the last seven years sales and service engineer for Mercoid Corporation in Chicago, is now service engineer with the Wheelco Cleveland office. Howard B. Jones, formerly with McGraw-Hill Publishing Co., has been employed as sales and service engineer at the Chicago office.

LEEDS & NORTHRUP Co., Philadelphia, Pa., received the Army-Navy Production Award on Sept. 5.

JENKINS BROS., manufacturers of valves, and workers in its Bridgeport (Conn.) plant received the joint Army-Navy "E" pennant Aug. 19 for excellence of production of war materials.

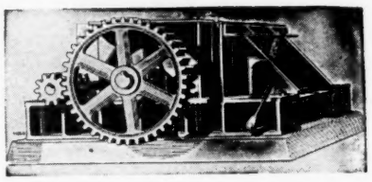
DUFF-NORTON MFG. CO., Pittsburgh, Pa., announces the appointment of J. F. Van Nort as general sales manager. He formerly served as western division sales manager. Before his affiliation with Duff-Norton he was sales manager of the eastern division of the Oil Well Supply Co.

ROLLER-SMITH CO., Bethlehem, Pa., announces that Roy M. Smith has joined the company as assistant chief engineer. Latterly he has been with the Bryant Electric Co., where he was engineering manager for the wiring device division. Prior to this, he was with Westinghouse.

B. E. SCHONTHAL & CO., INC., Chicago, announces that George Lindsay, of Eldorado, Ill., has become associated with the company and will confine his efforts to the sale of the products of the Johnson-March Corporation, New York City: Coaladd, for dust-proofing of coal, and Compound "M," for dustless mining.

STORAGE BATTERY DIVISION of Philco Corporation has been awarded the joint Army-Navy "E" in recognition of its war production record, according to M. W. Heinritz, general manager of the Trenton (N. J.) plant. The company was started in 1892 to manufacture storage batteries and is currently celebrating its 50th anniversary. Philco plants in Philadelphia and Sandusky, Ohio, also have been awarded the Army-Navy "E" for excellence in war production.

A NEW VERSION OF AN OLD TYPE



"PENNSYLVANIA" TYPE "K" SINGLE ROLL COAL CRUSHER

With this advanced design, in rugged STEELBUILT construction, far more accurate sizing is possible to meet Code requirements through quick adjustability, in a range from ¾" to 8".

Further—real protection is provided by improved Safety Toggle Equipment, which quickly passes Tramp Iron, and instantly returns Breakerplate to crushing position.

Seven (7) sizes afford a capacity range from 50 to 1000 tons per hour.

Send for Bulletin No. 2006.

Also,— **"PENNSYLVANIA" BRADFORD BREAKERS, BRADMILLS, GRANULATORS, HAMMERMILLS**

PUT YOUR COAL PREPARATION PROBLEMS UP TO US.

PENNSYLVANIA CRUSHER COMPANY

Liberty Trust Bldg. Philadelphia

Representatives in Principal Centers.

THOMAS MATCHETT, president, Robins Conveying Belt Co., Passaic, N. J., has been appointed to the Conveyor and Mechanical Power Transmission Industry Advisory Committee of the War Production Board. The company also announces that the implementing of measures to meet war production demands has resulted in the election of three additional vice-presidents: R. W. Eichenberger and E. C. Salzman, of the home office, and

Army-Navy "E" Banner Awarded Barber-Greene Co.

With Ashley Barber, vice president, presiding, the banner was awarded by Col. A. Robert Ginsburgh, military aide to Undersecretary of War Patterson. Each of the employees also received a sterling silver "E" pin. Colonel Ginsburgh and W. B. Greene, vice president and treasurer of the company, spoke briefly.

When You Pick The Wrong One . . . You Lose

And it is the same with wire rope.

As wire rope is used for many purposes, it is made in a wide range of grades, constructions and types. To obtain maximum results it is necessary to select the rope most suitable for the particular work it is to do . . . . the one that can win under the existing conditions.

When the "right rope" is not used, you are losing both time and money because replacements will have to be made more often; and what is *more* to the point—steel urgently needed for ships and shells is being wasted.

The accompanying illustrations show a few of the many wire rope constructions that are available. These can be furnished in different grades—either Preformed or Non-Preformed. They can also be supplied with either a hemp core, or a wire center of the type best suited for the job. Our experienced Engineering Department is at the service of all wire rope users to help make the proper selection. Feel free to consult us.

A. LESCHEN & SONS ROPE CO.

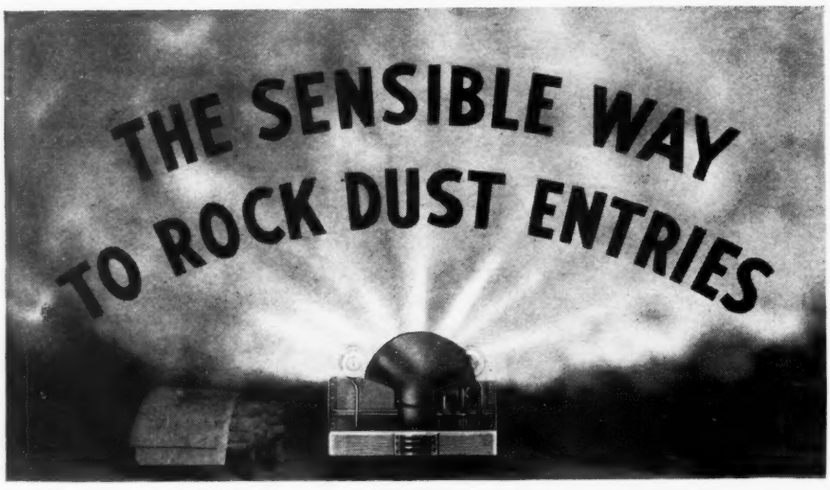
WIRE ROPE MAKERS — ESTABLISHED 1857

5909 KENNERLY AVENUE — ST. LOUIS, MISSOURI, U. S. A.

NEW YORK . . . 90 West Street
CHICAGO . . 810 W. Washington Blvd.
DENVER . . . 1554 Wazee Street

"HERCULES" (RED STRAND) WIRE ROPE

SAN FRANCISCO . . 520 Fourth Street
PORTLAND . . 914 N. W. 14th Avenue
SEATTLE . . 3410 First Avenue South



Uniform dusting is the safe way to spread 65 to 70% non-combustible dust. So effective has rock-dusting been in checking mine explosions that Insurance Companies and Compensation Bureaus make substantial insurance reductions for rock-dusted mines. What further proof is needed? Actual cost figures of three mines for example range from 0.00896 to 0.0125 per ton of coal mined.

"Dustributors" are most economical in operation and upkeep. The several types of "Dustributors" have been perfected to give maximum efficiency at a minimum cost. No more thorough rock-dusting jobs can be accomplished at any price. Operation of the "Dustributor" will save the wages of one man over any other method or machine. "Dustributors" may be purchased to suit the convenience of any mine. Write for catalog giving complete description of entry and room "Dustributor" specifications, and valuable rock-dusting information.

AMERICAN MINE DOOR COMPANY

2057 DUEBER AVENUE — CANTON, OHIO

The case hardened steel worms, bearing-bronze wheels, and copious lubrication give long life, without requiring attention other than occasional checking of oil level. The efficiency is high, reaching 97 per cent for certain ratios, and does not recede, but rather improves, with use. The transmission of power is shockless and noiseless.

Our engineers gladly supply data and give competent advice for the solution of speed transformer problems. Ask for Leaflet W-1128

DE LAVAL WORM GEAR DIVISION
of the De Laval Steam Turbine Co., Trenton, N. J.

MANUFACTURERS OF TURBINES · STEAM HYDRAULIC PUMPS · CENTRIFUGAL PROPELLER · ROTARY DISPLACEMENT · MOTOR MOUNTED · MIXED FLOW · CLOGLESS · SELF PRIMING · CENTRIFUGAL BLOWERS and COMPRESSORS · GEARS · WORM, HELICAL and FLEXIBLE COUPLINGS

J. F. Meissner, who remains as manager of the Chicago office. Messrs. Salzman and Eichenberger have been with the company since 1910 and Mr. Meissner since 1916.

THE BARBERTON (Ohio) WORKS of the Babcock & Wilcox Co. received the Maritime Commission "M" burgee on Sept. 2 in recognition of outstanding achievement. Rear Admiral Emory S. Land, chairman of the U. S. Maritime Commission and administrator of the U. S. Shipping Administration, bestowed the award.

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Trade Literature

BEARING METALS—Magnolia Metal Co., Elizabeth, N. J. Bulletin describes various lead-base metals found long-wearing on shock loads, on heavy sustained pressures, and on general service; and have proved to be satisfactory substitutes for tin base bearing metals. Practical suggestions are given for best results in making and maintaining journal bearings, with a table of recommendations for selecting the correct type of bearing metal for 135 different types of machinery. In addition, the bulletin also describes Isotropic bronze bushings, die-cast by the crystal-control method which produces a more homogeneous and stronger structure than that of ordinary bronze-bearing stock.

BRAZING MEDIUMS—Handy & Harman, New York City. Bulletin 12 describes and tells how to put Sil-Fos and Easy-Flo to work in a variety of industries. Silver alloy brazing of fabricated copper piping is outlined in another bulletin.

CARE OF RUBBER V-BELTS—Allis-Chalmers Mfg. Co., Milwaukee, Wis., Handbook, "Plain Facts on Wartime Care of Rubber V-Belts," aims to make complete sense of the entire V-belt maintenance story. How the anatomy of a V-belt affects its maintenance, how to obtain proper V-belt tension, what to do about worn sheaves, what determines the life expectancy of V-belts are some of the facts revealed.

CENTRIFUGAL PUMPS—DeLaval Steam Turbine Co., Trenton, N. J. Catalog B-3 describes two-stage centrifugal pumps of the opposed-impeller design. In this type of pump both impellers are of the single-suction type, the suction openings facing outwardly, so that axial thrust is balanced. Only two pairs of wearing rings are required, according to the manufacturer. The casing is so arranged that both the suction and discharge nozzles are in the lower half, and all parts of the pump are accessible and can be removed upon removing the casing cover. This type of pump is listed for capacities from 50 to 1,500 gal. per minute and for heads from 80 to 800 ft.

COAL CRUSHERS AND BREAKERS—McNally-Pittsburg Mfg. Corp., Chicago. Bulletin 342 details mechanical principles of crushers and breakers in relation to the crushing and breaking of coal sizes; contains capacity and dimension charts, line drawings and diagrams, ma-

chinery pictures, phantom view; and shows construction features.

COMMUTATOR RESURFACING EQUIPMENT—Cass Mfg. Co., Chicago. Catalog 28 illustrates complete line of motor maintenance material, giving instructions relative to use of commutator smoothing stones, grinding machines, etc. Sizes, grades and styles listed.

LATHES—South Bend Lathe Works, South Bend, Ind. Catalog 100 B describes the company's entire line of engine lathes, toolroom lathes, and turret lathes. The engine lathes and toolroom lathes range in size from 9- to 16-in. swing. The turret lathes are made in three sizes, having 9-, 10- and 16-in. swings. Specifications are tabulated to facilitate the selection of the lathe required for any desired application. Attachments, tools and accessories for adapting these lathes to special classes of work also are illustrated and described. Bulletin 1004 fully describes and illustrates 1003-C and 1004-C, new bench model turret lathes, and their construction features. Convenient tabulated specifications list all necessary information concerning capacities, feeds, speeds and dimensions. Bulletin H-1, "Keep Your Lathe Clean," shows how keeping lathes clean will help increase production, reduce scrap and lengthen the life of the lathe.

OVERBURDEN DRILLS—Paris Mfg. Co., Paris, Ill. Booklet cites uses and advantages of Parmanco drills, augers and accessories, giving mechanical details.

PLASTIC FIREBRICK—Mexico Refractories Co., Mexico, Mo. Booklet entitled "Mono-Fibric—High Grade Plastic Monolithic Firebrick," covers the advantages of use, methods of installation and application in lining horizontal return tubular and water-tube boilers, and all types of industrial and metallurgical furnaces.

STEELS—Babcock & Wilcox Tube Co., Beaver Falls, Pa. New Technical Data Card TDC-119 gives a complete combined list of standard steels of the American Steel and Iron Institute and the Society of Automotive Engineers, Inc.

TRACTOR MAINTENANCE — Cleveland Tractor Co., Cleveland, Ohio. New publication, "Cletrac Facts," gives practical suggestions for maintaining tractors in productive service: how worn lower track wheel shafts can be restored in about 3 hours by building them up through welding, then grinding them down to their original diameter; methods used to rebuild grousers by cutting, then welding lengths of stock to the worn grousers; how diesel lower track heels—worn to a taper—can be built up with from 3 to 5 lb. of electrode, then the face ground down to proper size; methods of rehabilitating lower track wheels by restoring the bead on wheels, using a home-made support to speed up the work; and how drive sprockets can be built up to their original contour. The type of welding electrode used to obtain the most satisfactory and economical results is recommended for each of the above jobs.

LONGER LIFE FOR CAR WHEELS

Wise care and maintenance of coal mine equipment was never more important than today. Wheels—plain or anti-friction bearing—should be greased regularly with the proper lubricant. Timken bearings should be checked for wear, and adjusted when necessary. Do not put plain bearing wheels on rough axles. Avoid locked brakes and the use of sprags.

★ *lubricate properly*

★ *check bearings regularly*

★ *use brakes wisely*

BROWN-FAYRO CAR WHEELS

Brown-Fayro wheels are cast in machined chills from a special alloy iron that gives an extremely hard tread, backed by tough close grained iron for maximum strength.

Wheels for anti-friction bearings are accurately machined to bearing manufacturer's tolerances and are carefully checked to assure uniform and concentric bores. Plain bearing wheels are finish reamed to provide bearing seats of maximum smoothness.

When ordering plain bearing wheels specify B-F "Ring Oiler" wheels—the oil ring carries an ample supply of lubricant to the axle at all hauling speeds.

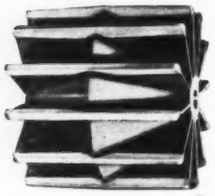
ALSO MFR'S OF:

"Brownie" Hoists, Blowers, Pumps, Retarders, Mine Cars, Rerailers and Sheaves. See PP. 43, 103, 123 of the Coal Mine Catalog.

THE BROWN-FAYRO COMPANY

940 ASH STREET JOHNSTOWN, PA.

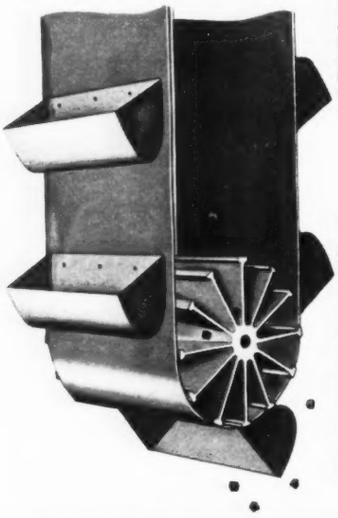
How BELT SAVER PULLEY SAVES



Users of "Belt Saver" pulleys report increases of 50% to 100% in belt life over that obtained when using ordinary pulleys. The Belt Saver not only prolongs the life of belts but actually outlasts the solid face pulley. Its wings or ribs do not break under normal operating conditions. The elimination of the grinding and crushing action that prolongs belt life also prolongs the pulley life. Belt Saver cannot in any way damage a belt. The wings or ribs are close enough to prohibit any crimping or flexing of the belt. Belt Saver can be interchanged with solid faced pulleys you now have in service. Get our new bulletin just off the press. Contains complete data on sizes, diameters, faces, shipping weights and prices.

- ★ Rubber
- ★ Time
- ★ Shut Downs
- ★ Maintenance Cost
- ★ Vital Materials

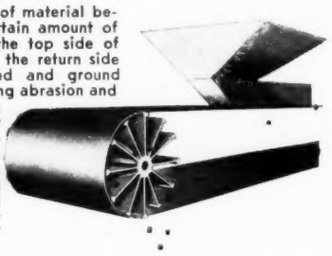
ON BUCKET ELEVATORS



Ordinary solid boot pulleys on bucket elevator installations literally "wallow" in the material being handled. Material that "back-logs" just *has* to get crushed between the face of a solid boot pulley and the belt. With the wing and cone construction of the Belt Saver the material is discharged at the side uncrushed. Because the wings represent less than 20 percent of the total pulley perimeter, Belt Saver offers less than 1/5 the wearing surface of an ordinary solid face pulley.

ON BELT CONVEYORS

Regardless of type of material being conveyed a certain amount of it "dribbles" off the top side of belt and falls onto the return side where it is crushed and ground into the belt—causing abrasion and serrations. When conveying sticky or moisture laden materials there is a "build-up" from dribblings causing misalignment. All of this is eliminated with Belt Saver.



(Reports of installations—names furnished on request)

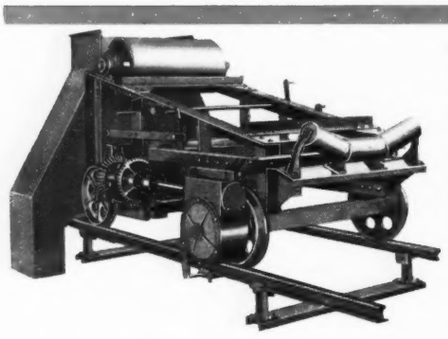
"Wing Type Pulley has given us very satisfactory service . . . saved us a tremendous amount of upkeep."

"Crushing of rock quartz probably involves more wear and tear on equipment than most minerals and we are well pleased with the performance of Wing Type Pulleys."

"Our experience, as result of installation, indicates your pulley has lengthened the life of this conveyor belt by 100%."

"We do not believe that we have ever had a rupture of the inside covering of a belt since we have been using your pulleys."

"Your pulley has lengthened the life of the belt on this ore elevator by from 75 to 100 percent."

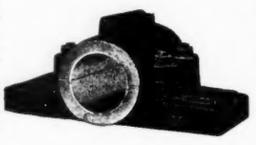


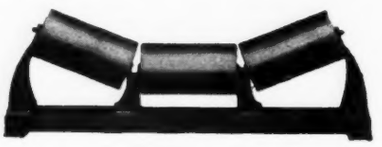
CONVEYOR TRIPPERS

Heavy duty Two-Pulley Tripper for use on belt conveyors handling coal. Operating mechanism is of steel worm gear type with fibre friction wheels providing the forward or backward movement. Large diam. track wheels insure against any possibility of slipping. Worm gear operation provides locking device when tripper is stationary.

PILLOW BLOCKS

Complete line including Rigid Angle Pillow Blocks, Heavy Pattern Common Pillow Blocks (with Broached Babbitted Bearings), and Self-aligning Hyatt Pillow Blocks.





CONVEYOR IDLERS

There is a Sprout-Waldron Anti-Friction Conveyor Idler for every conceivable purpose in the coal industry. Over 40 different types of Idlers from which to choose. You need Catalog No. 1500-A in your files. Write today.

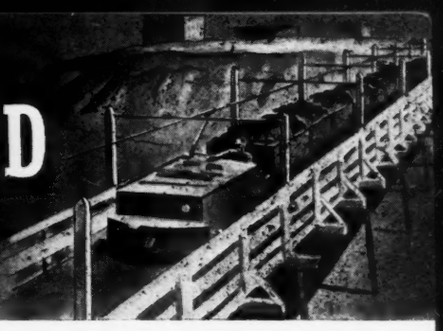
SPROUT-WALDRON *is also Headquarters for:*

- **Complete Bucket Elevators with cup sizes of 2 x 2 to 30 x 24 inches made of wood or steel.**
- **Screw Conveyors, all types, vertical or horizontal.**
- **Complete belt conveyor installations.**
- **Power Transmission Appliances, everything for the line shaft.**
- **Processing Equipment, grinders, mixers, sifters, etc.**

SPROUT, WALDRON & COMPANY

140 SHERMAN STREET — **MUNCY, PENNSYLVANIA**

MORE NEWS FROM THE FIELD



Rate Investigation Under Way: Truck Control Tightened

A series of nation-wide hearings on freight operating costs and their relation to rate-making was opened at Indianapolis, Ind., Sept. 21, by the Interstate Commerce Commission. The hearings were ordered by the commission to initiate a broad study into the factors affecting operating costs and tariffs. North-South differentials were among the topics under consideration at the Indianapolis hearing.

Relief to some 500 retail dealers in Nebraska, Iowa, Colorado and South Dakota was provided in an order issued earlier in the month cutting tariffs on shipments mainly from Colorado, New Mexico, Wyoming, Utah to the western half of the district covered in the complaints, and from Missouri, Arkansas and Oklahoma to the eastern half, plus some adjustments on anthracite and movement from the Great Lakes.

The effective date of General Order No. 18, requiring maximum loading of cars carrying civilian freight, was postponed from Sept. 15 to Oct. 15 by Joseph B. Eastman, Defense Transportation Director. He also lifted certain loading limits on water-borne freight.

The Office of Defense Transportation, under the terms of a drastic order designed to conserve rubber and gasoline, took complete control over every form of commercial truck transportation, effective Nov. 15. The order requires all owners to obtain certificates of war necessity to operate their vehicles and gives ODT the authority to require operation in "such manner, for such purposes and between such points as ODT shall from time to time direct."

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Operating Manual Prepared By Snow Hill Organization

A complete operating manual covering all phases of mining and preparation, safety, management and maintenance has been completed by the Snow Hill Coal Corporation for its Talleydale mine, near Terre Haute, Ind. Comprising 104 mimeographed pages, the manual was prepared by supervisors at the mine in conferences held under the auspices of the Indiana State Teachers' College in cooperation with the State Board of Vocational Education. Editing was handled by Kirk V. Cammack, instructor in mining, division of industrial arts and vocational education, State Teachers' College.

Despite the published material on coal mining, declares A. K. Hert, general superintendent, in the foreword, "it remains for each operating organization to work out and adopt a set of rules governing procedure for a given coal seam. . . . The purpose of assembling these ideas is to place in the hands of our foremen a handbook covering the various phases of the operation as a whole and its relationship to his department; also to pass along to the foreman of tomorrow information that may be valuable to him and to our company."

Keeping Step With Coal Demand

Bituminous Coal Stocks

Thousands

	Net Tons Aug. 1 1942	P.c. Change From July 1	P.c. Change From Aug. 1 1941
Electric power utilities	17,399	+2.7	+66.2
Byproduct coke ovens	9,922	+0.6	+59.6
Steel and rolling mills	1,178	+2.9	+62.9
Railroads (Class 1)	12,906	+5.6	+84.3
Other industrials*	27,666	+8.1	+72.0
Total	69,011	+5.0	+70.6

Bituminous Coal Consumption

Thousands

	Net Tons July 1942	P.c. Change From June 1942	P.c. Change From July 1941
Electric power utilities	5,713	+10.4	+9.5
Byproduct coke ovens	7,504	+3.8	+5.6
Steel and rolling mills	758	−1.0	−9.0
Railroads (Class 1)	9,080	+1.8	+16.4
Other industrials*	11,213	+0.1	+6.2
Total	34,268	+2.9	+8.7

* Includes beehive ovens, coal-gas retorts and cement mills.

Coal Production

Bituminous

Month of August, 1942, net tons	47,160,000
P.c. change from August, 1941	+1.1
January-August, 1942, net tons	380,300,000
P.c. change from Jan.-Aug., 1941	+18.1

Anthracite

Month of August, 1942, net tons	5,180,000
P.c. change from August, 1941	−4.8
January-August, 1942, net tons	40,028,000
P.c. change from Jan.-Aug., 1941	+7.6

Sales of Domestic Coal Stokers vs. Oil Burners

	Coal Stokers	Oil Burners
July, 1942	7,006	2,217
P.c. change from July, 1941	−73.1	−88.9
January-July, 1942	57,599	41,577
P.c. change from Jan.-July, 1941	−37.3	−64.8

Index of Business Activity*

Week ended Sept. 12 (preliminary)	186.3
Percent change from month ago	+0.7
Percent change from year ago	+15.6

* *Business Week*, Sept. 19.

Electric Power Output†

Week ended Sept. 12, kw.-hr.	3,570,919,000
Percent change from month ago	−2.3
Percent change from year ago	+12.2

† Edison Electric Institute.

Coal Priority Situation Quiet: Materials Shortage Grows

Relative quiet marked the priority front in September as far as coal mining was concerned although the War Production Board adopted a tougher attitude toward the Army and Navy and other consumers. And one regional director, Paul R. Smith, of New York, was quoted as stating that "the priority system as we know it is about to fall apart because the simple fact of the matter is that we have not got the materials. Within a very short time we probably will have 100 percent allocation of all materials."

More than 75 percent of the current steel output, it was announced in September, is going into direct war use (ordnance, munitions, ships, facilities, Army and Navy construction) and the remainder into such essential industries as railroads, machinery manufacture and the like. Revision of Priorities Regulation No. 10, setting up a "Production Code" under which all purchase orders are to bear a new series of code letters and symbols, was deferred from Sept. 1 to Oct. 1. Meantime, it was announced, the old allocation classification system would remain in effect.

Operators holding serial numbers under Order No. P-56 and using shovels in their operations were requested last month to supply information on: (1) minimum number of shovels which will be needed through 1943 for which preference applications had not been submitted or purchase orders placed; (2) description of shovel applications pending with the Mining Branch; and (3) preference ratings outstanding on which deliveries have not been made.

To compensate for wage increases granted by producers, the Office of Price Administration granted a price increase on wooden mine timber effective Sept. 8. This increase in ceiling levels applies to the Central Appalachian region and averages 20 percent.

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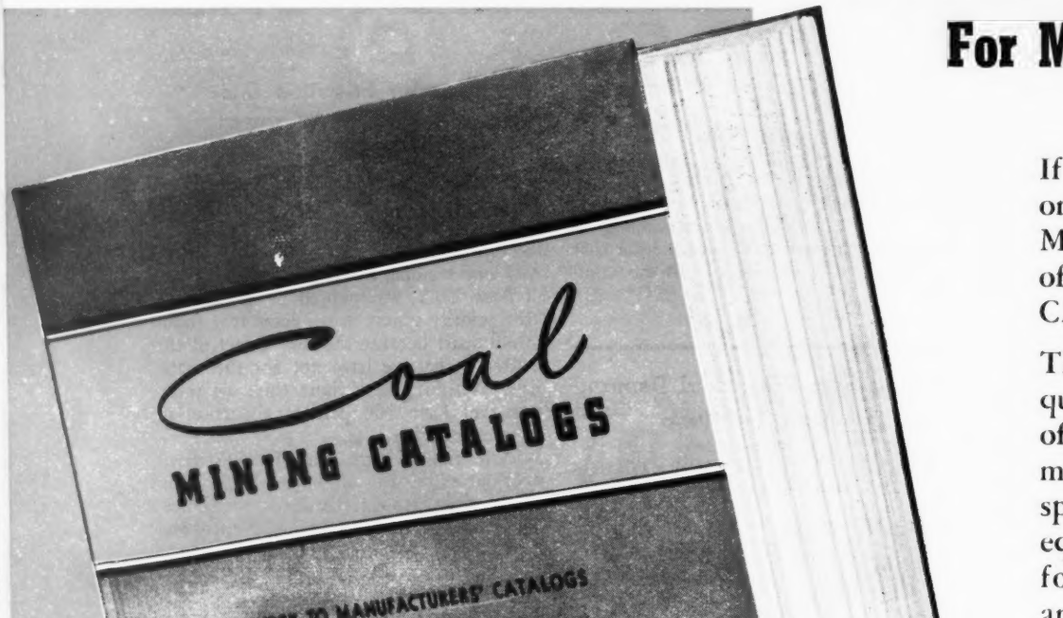
Illinois Institute Presents Golden Jubilee Program

The Illinois Mining Institute will hold its golden anniversary meeting Oct. 23 at the Abraham Lincoln Hotel, Springfield, Ill., with morning and afternoon sessions, topped off with a banquet in the evening. Papers to be presented are as follows:

"Federal Coal-Mine Inspections to Date," E. H. Denny, Chief, Coal-Mine Inspection Division, U. S. Bureau of Mines; "Industrial Salvage With Reference to Coal Mines," R. E. Snoberger,

YOURS FOR THE ASKING!

• • MANUFACTURERS' CATALOGS of Equipment and Supplies For MAINTENANCE



If you're looking for catalog data on equipment and supplies for Maintenance, turn to page 189 of your 1942 COAL MINING CATALOGS.

There you'll find indexed for quick, easy reference the catalogs of 84 manufacturers—up-to-the-minute data that will help you specify, requisition and buy the equipment and supplies you need for modern, efficient preventive and repair maintenance.

And this is only one of the seven sections in this helpful catalog you find packed full of useful data conveniently arranged for speedy reference. Use it daily for the information so essential to maximum production.

A Free* COAL AGE *Service to Mining Men

Today, where every minute saved means increased coal tonnage for essential war effort, you'll find COAL MINING CATALOGS more helpful and useful than ever before in your specifying, requisitioning and buying. In improved sectionalized form, with the latest catalog data from manufacturers, this new 1942 edition is one catalog you'll keep right at your elbow for daily, speedy reference.

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C.A., Oct., '42

COAL MINING CATALOGS, 330 West 42nd St., New York, N. Y.

Gentlemen: I am responsible for specifying, requisitioning, or buying equipment and supplies needed at our property, and do not have access to COAL MINING CATALOGS. Please forward me a copy of the 1942 Edition immediately. (If my country imposes a duty on such Catalog books, I agree to pay same.)

Name ..... *Title* .....

Company Name .....

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The nature of our operation is .....

Why BIXBY-ZIMMER ROUND-ROD PREPARATION SCREEN Serves Longer . . . Stops Waste

Round-Rod Design Adds to Screen Life . . . Extra Hard Alloys Resist Abrasive Wear

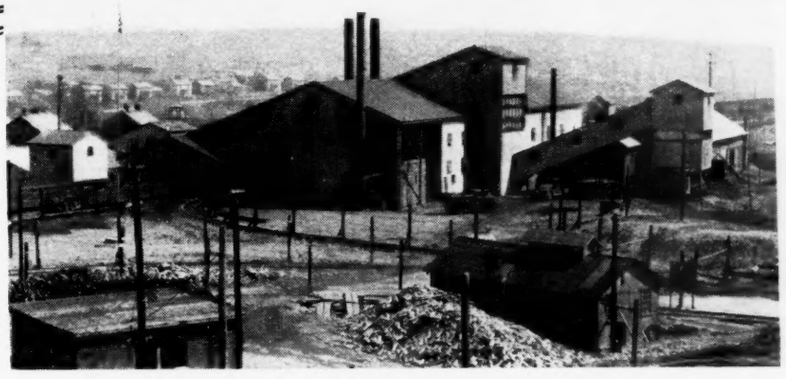
Coal is vitally needed today for the War effort. Your production is essential to Victory. Here's an opportunity to put a stop to "screening waste", at the same time, reduce maintenance expense. Install long-life, round-rod, hardened alloy Bixby-Zimmer Screens in your plant now.

Cuts Preparation Costs

Because of round-rod design, Bixby-Zimmer Screens last longer, stand up better under maximum demands of war output. Many of these screens are still in use after two and three years' service. Round-rod construction scientifically cuts wear to a minimum, helps maintain uniform, peak production for longer period of time.

Greater Hardness In Alloys

Added to that, Bixby-Zimmer Screens use alloys of exceptional hardness because rods are welded flat to frame, require no bending. This permits selection of hardened alloy in your Bixby-Zimmer Screen which is extremely resistant to abrasion.



Hanna Mine at Piney Fork Uses Bixby-Zimmer Screens

Leading coal preparation equipment manufacturers install Bixby-Zimmer Screens as original equipment. Thus, many plants throughout United States are enjoying the advantages of this screen, which effectively reduces surface moisture. The Hanna Mine at Piney Fork, Ohio, pictured above, has Bixby-Zimmer Screens in its Link-Belt Equipment.

You can either specify Bixby-Zimmer round-rod screens in your new equipment, or have it installed in your present plant.

Remember, coal is vital for Victory; take every precaution against waste, use every opportunity to get bigger production. Look into Bixby-Zimmer savings now.

Write Today FOR FREE BOOKLET

A free copy of new Bixby-Zimmer catalogue, giving size and construction details, will be sent you on request. Write today.

BEE ZEE

BIXBY-ZIMMER Engineering Co. Galesburg, Illinois

BIXBY-ZIMMER ENGINEERING CO.

961 ABINGDON ST. GALESBURG, ILL.

Why continue to cut and bow wire rope, weakening the strands, making serious accident possible?

Use the Safety Clip. It can't be put on wrong — inexperienced workers can't cause the dangers of the U-Bolt put on backward. The Safety Clip takes a powerful, all-round Fist-Grip on rope. The four flat bearing surfaces far out-hold the finger-pinching U-Bolt Clip, and cannot crush and crimp wire rope.

The Safety Clip Gives More Steel for Armaments!

25% less steel is used in a Safety Clip assembly equal in strength to a U-Bolt-held rope. That steel can go to arsenals and plane factories for all-out military needs. Fewer clips are needed — that saves steel, too. And the rope-ends stay straight and round for re-use — no expensive waste from cut-off crimped-up rope ends.

THESE ARE YOUR SAFETY SAVINGS

No rope crimping or bowing	rope saved
No special wrench	tools saved
Bolts on opposite sides	tightening time saved
Can't go on wrong	accidents saved
Fewer clips needed	clips saved
Fewer rope breaks	accidents saved
No bent, battered threads	clips saved

95% rope strength delivered by test.

Distributed exclusively through Mill Supply Houses
Look for Laughlin Products in Coal Mining Catalog

THE THOMAS LAUGHLIN COMPANY
PORTLAND, MAINE

Industrial Salvage Section, Bureau of Industrial Conservation, War Production Board; "Present and Future Possibilities for Smokeless Combustion of Illinois Coal," Prof. J. R. Fellows, University of Illinois; "Priorities for the Coal-Mining Industry," D. L. McElroy, technical adviser for coal priorities, W.P.B.

Thomas Moses will be toastmaster at the banquet, when Dean Charles M. Thompson, College of Commerce and Business Administration, University of Illinois, and chairman of the Committee on Adjustment of Business to War Conditions, Illinois State Council of Defense, will speak on "Some Fundamental Economic Truths."

•

House Committee Approves Anthracite Research Fund

The Mines and Mining Committee of the House of Representatives at Washington approved on Sept. 16 a bill (S. 357) to provide for the establishment and operation of a research laboratory in the Pennsylvania anthracite region to study the mining, preparation and utilization of anthracite, for the development of new uses and markets, for improvement of health and safety in mining, and for a comprehensive study of the region to aid in the solution of its economic problems and to make its natural and human resources of maximum usefulness in the war effort.

Identical legislation for the laboratory was introduced some time ago by Senator James J. Davis (R., Pa.) and Representative Ivor D. Fenton (R., Pa.). The Senate amended its bill, increasing the appropriation from $350,000 to $450,000 for construction and $175,000 annually for maintenance, and providing that the Secretary of the Interior, through the U. S. Bureau of Mines, might, at his discretion, create an advisory committee for consultation in connection with administration of the act.

Representative Fenton moved in the House that the Senate bill, with amendments, be substituted for his measure to expedite its passage and testified before the House Mines Committee in its behalf. He pointed out that the laboratory had been recommended by the Federal Anthracite Coal Commission in its report to the President and Congress on April 2 last.

•

Varied Mining Program Offered At Safety Congress

A varied program will feature the meeting, at the Sherman Hotel, Chicago, of the Mining Section at the 31st National Safety Congress and Exposition, Oct. 27-29. W. D. Haselton, safety supervisor, Pickands, Mather & Co., general chairman, will preside and the following papers will be presented: Oct. 27—"Electrical Blasting Underground": (a) Non-Metallic and Metal Mining, L. L. Naus, mining engineer, U. S. Bureau of Mines, Wilkes-Barre, Pa.; (b) Coal Mining, R. D. Currie, district engineer, General Reinsurance

Manufacturers' Catalogs on Maintenance

Valuable literature on maintenance of a wide variety of equipment and machinery

● Brief descriptions of the latest catalogs, bulletins and data, dealing with the subject of maintenance of the equipment and supplies of various manufacturers, have been listed in this convenient directory. Although not complete (consisting of information submitted prior to press date by the manufacturers represented), we believe readers concerned with the present day important problems of maintenance will find this directory useful. COAL AGE has made arrangements to bring this information, without cost or obligation, to active men connected *only* with the coal mining industry, particularly the operating officials, executives and men interested in and responsible for maintenance operations in this field.

Simply check by number *only* those descriptive bulletins or data you would like to have on the postal card you will find on the fourth page of this section and mail it to COAL AGE.

Coal and Rock Drills

1 BACHARACH - STRAUSS. Bulletins describing construction and operation of "Kop" bits and augers for coal drilling service.

2 BETHLEHEM STEEL CO. Booklet 83-C, 28 pages, gives facts on Bethlehem Superior Hollow Drill Steel.

3 CHICAGO PNEUMATIC TOOL CO. Bulletin on Maintenance and Operating Instructions for Type 700 and 900 Mounted Electric Coal Drills.

4 INGERSOLL-RAND CO. "Drill Doctor's Book," 72 pages, on maintenance and repair of rock drills. Also a series of single-page bulletins on "How to Get the Most Out of Your Rock Drills."

5 INGERSOLL-RAND CO. Bulletin No. 1B-5050, 24 pages, on Instructions for the Care and Operation of I-R Drill Steel Sharpeners, Shank and Bit Punches, and Oil Furnaces, also bulletin on Re-Grinding and Threading of Jackbits.

6-8 SULLIVAN MACHINERY CO. Bulletins on care and operation of rock drills, as follows: Class L-1, 30 lb. rock drill (6); Class L-57, 55-lb. rock drill (7); Class L-2 rock drill (8).

Construction and Fabrication

9 BETHLEHEM STEEL CO. Catalog S-51; 134 pages of information and tables for engineers and designers of buildings and other steel structures.

10 FALSTROM CO. Bulletin 101, 4 pages illustrates various fabricated steel products for different industries, such as gear inclosures, conveyor baskets, feed bins, dust control fittings and housings, tanks, coal chutes, etc.

11 ARMCO DRAINAGE PRODUCTS ASSN. Four-page folder of illustrations of Armco Liner Plates for mine slopes, and underground rooms.

Conveyors

12 GOODMAN MFG. CO. 10-page maintenance and operation manual on installation of belt conveyors for conveyor mining.

13-16 GOODMAN MFG. CO. Bulletins on maintenance and operation of shaker drives, as follows: Types G-12½, G-15, G-20 (13), Type J-10 (14), Type E-11 (15), Automatic Duckbill Type A (16).

Cutting Machines

17-31 GOODMAN MFG. CO. Bulletins on care and maintenance of cutting machines, as follows: Types 124 and 224 slabbing machines (17); Type 324 slabbing machine (18). Type 412 low-vein shortwall (19); Type 424 slabbing machine (20); Type 924 slabbing machine (21); Type 1124 slabbing machine (22); contactor control for Type 412 shortwall (23); Type 512 shortwall (24); contactor control for Type 512 shortwall (25); power trucks for shortwalls (26); Type L-29 arc face machine (27); Type 824 slabbing machine (28); Type 1124 slabbing machine (29); the 724 gobber (30); Type 112 shortwall (31).

32-33 SULLIVAN MACHINERY CO. Booklet No. 79-L, 2nd edition, 66 pages, on instructions for operation, care and repair of Sullivan Ironclad Continuous Coal Cutters. (32); Booklet No. 5177, on Instructions for Operation, Care and Maintenance of Sullivan Type 7-B Shortwall Coal Cutter (33).

34 JEFFREY MFG. CO. Bulletin 699-A, a maintenance manual in 12 sections on Jeffrey 29-U Universal coal cutter.

35 THE CINCINNATI MINE MACHINERY CO. 16-page booklet and bulletins on instructions for use and maintenance of Cincinnati Duplex cutter chains.

36 FRANK PROX CO. 4-page folder giving details of Prox tool steel cutter bits and chain.

37 GUYAN MACHINERY CO. Data on maintenance of mining machine and locomotive resistances.

38 AMERICAN MINE DOOR CO. 4-page folder describes "Canton" fingerboards for Goodman and Jeffrey cutting machines.

Electrical Equipment (Motors and Control, Circuit Breakers, Generators, Transformers and Accessories)

39 ALLIS-CHALMERS MFG. CO. 28-page handbook "A Guide to Wartime Care of Electric Motors."

40 IDEAL COMMUTATOR DRESSER CO. Bulletin on maintenance of electric motors and generators with modern commutator stones, grinders, mica undercutters, brush seater, etc.

41-48 GENERAL ELECTRIC CO. The following bulletins on care, maintenance and selection of motors, controls, etc.: Bulletin 8030, 12 pages, on "How to Care for Motors" (41); Bulletin 8490, 8 pages, "Maintenance Guide on Industrial Control" (42); Bulletin No. 8398 on "How to Maintain D. C. Motors" (43); Bulletin 8058 on "How to Select A. C. Motors and Control" (44); Bulletin 8398 on "How to Select D. C. Motors and Control" (45); Bulletin 225 on "Reconditioning Flooded Electric Equipment" (46); Bulletin G.E.T.-885, 4 pages, on cleaning and drying flooded transformers (47); Bulletin G.E.T. 677-B, 4 pages, on repainting transformers in the field (48).

49-50 WESTINGHOUSE ELECTRIC & MFG. CO. Wall check chart for maintenance of motors, control equipment, lightning arresters, wiring, fuses and transformers (49); Booklet illustrates and details the FSL maintenance plan for Fewer Repairs, Shorter Repairs, and Long-Lasting Repairs (50).

51 WESTINGHOUSE ELECTRIC & MFG. CO. 2-page bulletin on maintaining explosion-proof electric motors and control equipment.

52 ELECTRO-NITE CARBON CO. Catalog No. 7, 24 pages; gives detailed data on various types of brushes, selection for a given service, and fitting instructions.

53 NATIONAL CARBON CO. A series of 11 bulletins detailing much information on brushes and commutation.

54 I.T.E. CIRCUIT BREAKER CO. Data on maintenance of automatic reclosing circuit breakers.

55 CASS MFG. CO. Catalog No. 28 illustrates their complete line of motor maintenance material, such as commutator smoothing stones, grinding machines, etc.

Electrical Wire & Cable

56 DELTA-STAR ELECTRIC CO. July-Aug. bulletin includes article on open-wiring for war plants and facts on different constructions, including tables for quick determination of voltage drop.

57 ROCKBESTOS PRODUCTS CORP. Bulletins describing details and application of Rockbestos wire and cable.

58 SIMPLEX WIRE & CABLE CO. 4-page folder gives splicing instructions for Simplex-Tirex rubber-jacketed cables.

59 THE OKONITE CO. 8-page folder gives "Do's, Don'ts and How's" for longer life with insulated wires and cables. Also a large wall chart with illustrations on "How to Make a 'Perfect Splice' ".

60 AMERICAN STEEL & WIRE CO. 56-page catalog gives facts and illustrations of their various types of cords and cables. Also a 4-page bulletin on how to conserve rubber in insulated wires and cables.

61-66 GENERAL ELECTRIC CO. The following bulletins on cable joints, failures, etc.; No. 2987, 44 pages, on "How to Make Cable Joints for Leaded Cable" (61); No. 2988, 16 pages, on "How to Make Cable Joints for Non-Leaded Rubber and Varnished-Cambric Cable" (62); No. 2889, 16 pages, on "How to Make Cable Joints for Portable Cable" (63); No. 3362, 2 pages, on "How to Terminate Braided, Shielded, Single-Conductor Cable" (64); No. 3361, 2 pages, on "How to Terminate Tellurium Parkway, Shielded, Single-Conductor Cable" (65); No. 3325, 4 pages, on "Locating Underground Cable Failures" (66).

67 HAZARD INSULATED WIRE WORKS, Div. of Okonite Co. Catalog No. 179, 48 pages, gives details and illustrations of cables for various mine machinery and mine power uses.

68 AMERICAN MINE DOOR CO. 8-page bulletin gives details on the use of their "Canton" cable splicers, welding bond binders and terminals, and wire rope binders.

Explosives

69 ATLAS POWDER CO. 12-page folder on nine ways to get the most from your explosives.

70 E. I. DU PONT DE NEMOURS & CO., INC. Chapter VDI of new edition of Blasters' Handbook, gives information on proper handling and storage of explosives and blasting accessories.

Haulage, Underground

71 BETHLEHEM STEEL CO. Bulletin No. 131, 16 pages, on "Here's How to Get the Most From Your Haulage System." Includes illustrations and data on rails, steel ties, crossings, turnouts, switches, frogs, mine cars, hydraulic brakes and mine car wheels.

72-74 BETHLEHEM STEEL CO. The following booklets and folders on track equipment and supplies: Bulletin No. 72-A, 136 pages, on Mine Track Equipment; Booklet No. 71, 82 pages, on Steel Mine Ties and Light Rails, (72); Leaflet on Mine Car Stop with Sprag (73); Leaflet on Target Stand for Switches, (74).

75 INDIANA FOUNDRY CO. 8-page bulletin gives details of construction, operation, capacity, gratings and repair parts of their "Sutton" sand drying stoves.

76 THE COOVER RAILROAD TRACK BRACE CO. Bulletin describes protection for narrow and standard gauge track with Coover track braces.

77-83 OHIO BRASS CO. Past monthly issues of "Haulage Ways" give much information on maintenance of various haulage equipment, such as line material (77), rail bonds (78), automatic control and overload protection for equipment in gassy mines (79), switching and protection equipment (80), automatic car couplers (81), how to cut high power losses in mine distribution circuit (82), and power interruptions affected by sectionalization program (83).

84 THE JEFFREY MFG. CO. Bulletin No. 256, 24 pages, contains instructions for the care and operation of Jeffrey electric mine locomotives.

85 GENERAL ELECTRIC CO. Bulletin No. GEH-239-A, deals with instructions covering the general care and operation of G.E. mine locomotives.

86 BETHLEHEM STEEL CO. 4-page folder describes their forged steel wheels for mine cars.

87-89 AMERICAN MINE DOOR CO. 8-page bulletin gives details and illustrations of the "Canton" mine car transfer, (87); 16-page booklet No. 76 contains construction data and application of the "Canton" automatic signal and flagger (88); 12-page folder describes their "Canton" automatic track devices—switch-throwers (89).

Hoists (Scraper, Room, Car Puller)

90-94 SULLIVAN MACHINERY CO. Bulletins on care and maintenance of scraper haulers and hoists, as follows: Bulletin No. 5128, 16 pages, on double-drum scraper haulers with foot-mounted type motor (90); Bulletin No. 5131 on trip e-drum scraper haulers (91); Bulletin No. 5058, 43 pages, on single drum hoists, external motored (92); Bulletin No. 4157, 6 pages, on room hoists (93); Bulletin No. 4118, on operation and maintenance of their Class C. H. E.—5, C. H. E.—10, and C. H. E.—15 car-pulling hoists (94).

Lamps, Miners' Electric Cap

95 KOEHLER MFG. CO. Manual No. 88 on care and maintenance of Wheat electric mine lamp constant potential system.

Loading Machines

96-100 GOODMAN MFG. CO. The following bulletins on maintenance and operation of loading machines; Type 460 track-type hydraulic loading machines (96); Type 360 track-type loading machines (97); Type 260 track-type loading machines (98); contactor control for 360 and 460-track type loading machines (99); hydraulic control system for 360 and 460 track loaders (100).

101-102 JEFFREY MFG. CO. The following bulletins on maintenance of their loading machines: Bulletin 699-D on Jeffrey L-600 machine (101); Bulletin 699-C on Jeffrey L-500 machine (102).

103 PHILLIPS MINE & MILL SUPPLY CO. Bulletin describing the Phillips loader carrier car for moving caterpillar-type loaders.

Lubricants

104 JEFFREY MFG. CO. Bulletin No. 734-A, 12 pages, gives lubricating specifications for Jeffrey machinery.

105 MACMILLAN PETROLEUM CORP. Booklet No. 117, 36 pages, is a lubrication guide for Internal Combustion Engines and Compressors.

106 ALEMITE DIV. OF STEWART-WARNER CORP. Bulletin No. 22-42, 12 pages, features portable lubricating equipment for power lubrication on the job, also data on three new portable "service" stations for lubricating equipment.

107-109 STANDARD OIL CO. OF INDIANA. Bulletins on lubricating practices, as follows: Bulletin No. M-118, 56 pages, an engineering treatise on lubrication of mining equipment (107); 8-page bulletin on mine car lubricating practices (108); 12-page bulletin on "Facts About Grease and Grease Lubrication with Superla Numbered Greases and Superla "X" Greases" (109).

110 INGERSOLL-RAND CO. 6-page folder No. 2795 on proper lubrication of rock drills.

Mechanical Rubber Goods and Supplies

111-117 B. F. GOODRICH RUBBER CO. Leaflets on "How to Get the Most Service Out of Industrial Rubber Products," as follows: 1. Transmission Belting (111); 2. Conveyor Belts (112); 3. V-Belt Drives (113); 4. Belt Salvage (114); 5. Rubber Hose (115); 6. Mats and Matting (116); 7. Rubber Gloves (117).

118 GOODYEAR TIRE & RUBBER CO. 40-page manual, "Goodyear Industrial Rubber Products Conservation," describes and illustrates care and maintenance of conveyor and transmission belting, V-belts and hose.

119 SO-LO WORKS. Bulletin describes their rubber plastic products for patching and maintenance of various rubber products.

120 B. F. GOODRICH RUBBER CO. 4-page Catalog Section 2158 describes use of portable belt vulcanizers for splicing and repair jobs.

121 MANHATTAN RUBBER DIV. OF RAYBESTOS-MANHATTAN, INC. Wall manual on proper care of conveyor, transmission and V-belts; wall card on proper care of their fire hose, also wall chart on proper care of rubber hose.

122 NEW YORK BELTING & PACKING CO. Booklet M-2580, 24 pages, on how to get longer life out of your mechanical rubber goods.

123 U. S. RUBBER CO. Booklet M-2506, 48 pages, a rubber conservation manual with facts on elevator, conveyor and transmission belting, packing, electric wires and cables, rubber-lined equipment, etc.

124 ROBINS CONVEYING BELT CO. Wall card, "For Proper Care of Your Rubber Conveyor Belting", includes detailed recommendations by Robins engineers. Also a bulletin on maintaining conveyor belts with Malacca plastic rubber.

Pipe, Valves and Fittings

125 READING, PRATT & CADY DIV. OF AMERICAN CHAIN & CABLE CO. Their "Triangle" publication gives pertinent facts on valve maintenance.

126-128 CRANE CO. 4 bulletins, as follows: "Helpful Hints on Choosing Valves for Better Piping Service," and "Tips on Valve Trim to Help Keep Piping on the Job," (126); "How to Keep Your Plant Going Without Interruption" (127); "11 Simple Ways to Get Better Service from Piping Equipment," (128).

129 NATIONAL LUMBER MANUFACTURERS ASSN. 4-page bulletin gives data on advantages of wood pipe for drainage, water supply or sewage.

Pumps and Fans

130 THE DEMING CO. Bulletin No. 1000, 16 pages, describes their mine pumps and accessories.

131 GOULDS PUMPS, INC. Folder of pump application sheets, including 18-page booklet on "Pump Fundamentals."

132 GOYNE STEAM PUMP CO. 4-page bulletin gives information on increased life of their special adjustable type pump for coal-cleaning systems and sludge disposal service.

133 WARREN STEAM PUMP CO. 16-page bulletin on maintenance and lubrication of pumps.

134 AMERICAN MINE DOOR CO. 16-page bulletin gives information on use of "Canton" automatic mine doors and construction details of the different types.

135 ROBINSON VENTILATING CO. Circular letter of recommendations for mine ventilating fan maintenance.

Power Plant and Power Transmission Equipment

135a ALLIS-CHALMERS MFG. CO. 16-page handbook on "Wartime Care of Rubber V-Belts."

136 LINK-BELT CO. May issue of "Link-Belt News" gives detailed information on how to get more service out of chain drives. June-July issue contains article "Machinery Is Ammunition, Too— Care for It Wisely."

137 MANHEIM MFG. & BELTING CO. Two bulletins present graphic story of improved machine operation with the Veelos adjustable V-belt.

138 THE BABCOCK & WILCOX CO. 8-page folder, reprint of an article, "Maximum Output from Existing Boiler Plants."

Protective Coatings

139 CARBOZITE CORP. 4-page bulletin on their protective coatings, including data on coal mine applications.

140 PROTECTIVE COATINGS INCORPORATED. Descriptive bulletins on the Tocol line of technical coatings for various plant and equipment applications to meet corrosion, heat and other problems.

Rock Dusters

140a AMERICAN MINE DOOR CO. Bulletin No. 106, 16 pages; Describes rock-dusting practice and gives specification data on their various models of rock-dusting machines.

Scales

141 STREETER-AMET CO. Circular letters give information on maintenance of scales.

Shovels and Draglines

142 LIMA LOCOMOTIVE WORKS, INC. 84-page instruction book on the care and operation of Lima excavators with lubricant specifications from 18 well-known oil companies.

Tools, Tool Steel and Other Supplies

143 BLACK & DECKER MFG. CO. 16-page handbook on "Proper Care and Maintenance of Portable Electric Tools."

144 THE DUFF-NORTON MFG. CO. A wall poster on a dozen don'ts—safety hints—for users of lifting jacks.

145 GIBRALTAR EQUIPMENT & MFG. CO. Bulletin on use and care of "Gemco Tru-Blu" portable mining tools, such as tool and supply cars, pressure grease guns, rail benders and straighteners, rail punches, rail leveler, and car mover.

146 BETHLEHEM STEEL CO. Handbook No. 159; 154 pages of detailed data on bolts, nuts, rivets and spikes.

147 BETHLEHEM STEEL CO. Catalog T-8; 52 pages, descriptive of various tools, such as punches, dies, shear blades, chisels, circular saws, letter and figure stamps.

148 THE WOOD SHOVEL & TOOL CO. Catalog F-1942; 84 pages of detailed data, including illustrations, of their hand shovels, scoops, and spades.

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149 FALSTROM CO. Bulletin No. 104, 4 pages, describes and illustrates their Barrel-Lift for lifting, moving, tilting or turning barrels, drums or containers.

150 JOHNS-MANVILLE. Booklet gives 101 suggested good operating practices for using packings, insulations, roofings, friction materials and refractory cements.

151 BETHLEHEM STEEL CO. Two wall charts, one on "Some Ways to Conserve Tool Steel, Ten Tips on Hardening," and the other chart on "Do's and Dont's of Forging."

152 QUICK REPAIR WASHER CO. 4-page leaflet describes the use of their split washers and collars.

Truck and Trailer Equipment

153 THE B. F. GOODRICH CO. 100-page "Operator's Handbook" on tire specifications for trucks, trailers and tractors. Includes many useful charts and tables.

154 THE GOODYEAR TIRE & RUBBER CO. 36-page booklet on "How to Make Your Rubber Tires Last Longer."

155-156 HERCULES MOTORS CORP. Booklet No. 278, 24 pages, an "Operator's Handbook" on the GX and HX series engines, including lubrication and maintenance data for trucks (155). Also a 100-page "Maintenance Manual," covering their various types of compression - ignition - injection diesel engines. Note—Price of this manual is $2 for anyone requesting it (156).

157-158 CUMMINS ENGINE CO. 16-page booklet gives detailed specifications of their automotive type diesel engines (157); also 64-page "Owner's Manual," which gives detailed data on their diesel engine parts for the model "H" series (158).

159 WAUKESHA MOTOR CO. Catalog 908L, 50 pages, on general instructions for the care and operation of Waukesha-Hesselman oil engines with vacuum fuel-air control.

160 LIPE-ROLLWAY CORP. 20-page booklet, "The Clutch Service Manual," with details and line drawings of clutch installation data.

161 FULLER MFG. CO. Data and line drawings on their transmissions in combination with The American Blower hydraulic coupling, for heavy-duty trucks. Also service manual No. 5, 20 pages, on operation, lubrication and servicing of Fuller transmissions and clutches.

162 VICKERS, INC. Bulletins on vane type pumps for hydraulic operating systems, and Vickers hydraulic steering booster.

163 MACK MFG. CORP. A set of preventive maintenance schedules for truck users.

164 BENDIX-WESTINGHOUSE LOCOMOTIVE AIR BRAKE CO. Bulletin B. W. 5057-B gives details and line drawings on air brakes for motor trucks.

165 TIMKEN-DETROIT AXLE CO., also WISCONSIN AXLE DIV. Field Service Bulletins Nos. 2, 6, 10, 13 and 14 give maintenance and lubrication data on their axles, worm gear driving units, and brakes.

166 ROSS GEAR & TOOL CO. Service Bulletins Nos. 210-A and 295-L give details and illustrations on lubrication of Ross cam and lever steering gears.

Welding and Metallizing

167 GENERAL ELECTRIC CO. 17-page bulletin on "How to Keep Your Arc Welders Welding."

168-170 LINCOLN ELECTRIC CO. Bulletins on arc welding as follows: Bulletin No. 402, 60 pages, "The Lincoln Weldirectory," (168); Bulletin No. 432, 20 pages, "The 'Fleet Fillet' Welding Technique for Speeding War Production" (169); Bulletin No. 366, 4 pages, "A Complete Welding Service to Lincoln Users" (170).

171 METALLIZING CO. OF AMERICA, INC. 56-page booklet on "The History, Purpose and Practice of Metallizing (Metal Spraying)."

172 A. O. SMITH CORP. Bulletin No. 531-A, 4 pages, gives details of the Smith Arc-Length Monitors for training of new welders and simplifying "controlled" welding by hand.

173 STOODY CO. Various issues of "Fusion Facts" give interesting applications of their hard-surfacing welding rods.

Wire Rope

174 AMERICAN CHAIN & CABLE CO., INC., HAZARD WIRE ROPE DIV. 24-page booklet contains many recommendations for the safe use of wire rope.

175 BETHLEHEM STEEL CO. Catalog No. 154, 128 pages of detailed information on their wire rope and strand for various uses.

176 A. LESCHEN & SONS ROPE CO. 48-page bulletin on "Practical Information on the Use and Care of Wire Rope."

Wood Preservatives

177 E. I. DU PONT DE NEMOURS & CO., INC. 8-page booklet explains applications and advantages of du Pont chromated zinc chloride for mine ties and timbers; also the April-May issue of du Pont Magazine contains an article on "CZC" Wood Preservative.

COAL AGE

Please have the manufacturers send me, without obligation, the literature circled below. Numbers correspond to descriptive paragraph numbers.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
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152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168
169	170	171	172	173	174	175	176	177								

Please circle only those bulletins in which you are particularly interested.

MY NAME.....TITLE.....

COMPANY .....

ADDRESS .....

The above must be filled out COMPLETELY in order to secure the literature you request.

Corp.; "Benefits a Mining Company May Expect From Establishment of an Industrial Hygiene Plan," Dr. Leonard Greenburg, Director, Division of Industrial Hygiene, State Department of Labor, New York City.

At the luncheon on Oct. 27 there will be an address by Robert A. Bryce, president, Canadian Institute of Mining and Metallurgy.

Oct. 28—"Transportation Injuries: Causes and Prevention in Mining"—(a) Statistical Analysis, W. W. Adams, supervising statistician, U. S. Bureau of Mines, Washington; (b) Bituminous-Coal Mining, Harry M. Moses, president, H. C. Frick Coke Co., Pittsburgh, Pa.; (c) Anthracite Mining, C. G. Brehm, supervisor of safety and compensation, Susquehanna Collieries Co., Nanticoke, Pa.; "Safety Precautions in Shuttle-Car Operations," E. J. Weimer, division superintendent, Koppers Coal Division, Eastern Gas & Fuel Associates, Grant Town, W. Va.

On the afternoon of Oct. 29 there will be a safety symposium, when anyone present may present his own safety topic for informal off-the-record discussion.

There will be an election of officers at the close of the first day's session, and the new officers will be introduced at the close of the second day's session.

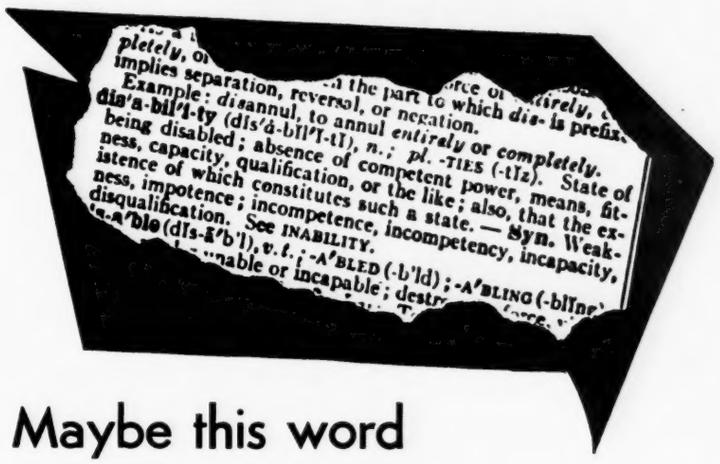
•

Redyard Succeeds Rhinehart As W. Va. Mine Chief

Jesse Redyard, of Wyoming County, former member of the staff of the U. S. Bureau of Mines, has been named by Governor M. M. Neely as chief of the State Department of Mines of West Virginia, effective Sept. 1. He succeeds N. P. Rhinehart, who held the post since 1933, serving during the current year without appointment.

A native of Illinois, Mr. Redyard began work in the mines at the age of 15. At a comparatively early age he was appointed chief mine inspector of the State of Arkansas. Thence he went with the U. S. Bureau of Mines, developing contacts

Jesse Redyard


pletely, o
implies separation, reversal, or negation.
Example: disannul, to annul entirely or completely.
dis'a-bil'i-ty (dis'ă-bil'i-ti), n.; pl. -TIES (-tiz). State of being disabled; absence of competent power, means, fitness, capacity, qualification, or the like; also, that the existence of which constitutes such a state. — Syn. Weakness, impotence; incompetence, incompetency, incapacity, disqualification. See INABILITY.
-a'ble (dis-ā'b'l), v.t.; -A'BLED (-b'ld); -A'BLING (-blĭng)
-nable or incapable; destr

Maybe this word should be spelled

dis-a-BILL-i-ty

When a coal mine worker is laid up by sickness or accident, that's the way he might well be inclined to feel about its spelling . . . unless he is protected by a Provident HUMAN SECURITY plan, now enjoyed by the workers in many coal mine operations throughout the nation.

These plans, without cost to Employers other than permitting premium deductions over the payrolls, provide Employees with emergency income to help them meet extra expenses caused by such emergencies as

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- Loss of time through Accident or Sickness
- Death of the Employee
- Dismemberment

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KNIFE & FORGE CO.

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N. S., Pittsburgh, Pa.

with miners and operators at district, company and State-wide safety meets.

Leaving the federal bureau, he joined the Consolidation Coal Co. as director of safety. He also became associated with the Island Creek Coal Co. and the Koppers Co. for short periods until he became engaged in producing activities, opening a wagon mine on Huff Mountain, in Wyoming County, in southern West Virginia.

Mr. Redyard's appointment was indorsed by officials of the United Mine Workers and operators' associations. Asking for the cooperation of both miners and operators, Mr. Redyard, on taking office, assured them that the campaign for greater safety in the mines would be continued without interruption.

Sizable Coal Use Other Than as Fuel Reported To American Chemical Society at Buffalo

Output of Plastics Exceeds 180,000 Tons, Coal Being Principal Source—Other Coal Uses Discussed Include Synthetic Rubber, Aromatics, Cation Exchangers, Hormones and Dyes—Rubber Found in Coal—New Data Revealed on Coal Caking, Oxidation and Swelling

BELIEVING that, in the immediate future and even today, coal has a higher destiny than to serve merely as a source of heat, which has been its almost universal use up to the present, the Division of Gas and Fuel Chemistry of the American Chemical Society, meeting at Buffalo, N. Y., Sept. 9-10, held a symposium on "Uses of Coal by Various Industries" and heard articles relating to coking, flame, gas formation, corrosion by flue gas; the oxidation, ignition temperatures and swelling of Illinois coals, also the use of coal for heat by the cement industry.

Plastics Progress Is Coal's Opportunity—Exclusive of cellulose derivatives, 180,000 tons of synthetic resins was produced in 1941, estimated Reginald L. Wakeman, Mellon Institute, and B. H. Weil, Gulf Research & Development Co. In 1927 the production was only 6,775 tons; thus the increase in 14 years was about 26-fold. As late as 1940, however, plastics output was still less than 0.5 percent of the production of steel.

Intermediates From Coking

The conversion of coal into byproduct coke has long been the chief source for the intermediates consumed by the plastics industry, basic materials being (1) light oil and coal tar, (2) water gas and (3) the coke itself. About 7 percent of the benzene produced, 80 percent of the tar acids (natural and synthetic), 66 percent of the naphthalene and all of the cumarone-indene from light oil and coal tar went into the 1941 production of phenolics, nylon, polystyrene, alkyds and cumarone-indene resins.

Of the 1941 formaldehyde production, close to 75 percent was consumed by such resins as the phenolics, ureas and melamines. Intermediates in the production of methyl cellulose and the methacrylates also were produced from water gas.

Acetylene from calcium carbide is a source of numerous thermoplastics, although coal, in this field, has to compete with petroleum hydrocarbons. Both acrylonitrile for synthetic rubber and melamine are produced from coke through calcium cyanamide.

While petroleum derivatives, agricultural products and natural resins will compete keenly with coal, a sound program of research should enable coal to play a vital role in the future expansion of the plastics industry. It now appears certain that, after the war, plastics, because of their availability at reasonably low cost, will have greatly expanded application to civilian needs.

"Plastics are today playing a vital part in the war effort," Drs. Wakeman and Weil declared. Crystal-clear plastics under trade names such as Lucite and Plexiglas are invaluable in the transparent windscreens of bombers and fighter planes. Bakelite, Durez and Resinox, familiar in many objects in daily use, have been drafted by the armed forces for gun stocks, the nose pieces of trench-mortar shells and for use in an infinite variety of more prosaic, but vital, land, sea and aircraft equipment.

"That plastics play no little part in our economic system is evidenced by the 232,785 tons manufactured in 1940, a total exceeded in 1941. This compares favorably with the 206,280 tons of aluminum and somewhat larger tonnages of copper, zinc and lead produced last year.

"Phenol, popularly known as carbolic acid, is derived from coal tar and light oil, either directly or through benzol. Its use in plastics has caused its production to increase remarkably. Not before 1910

COMING MEETINGS

- Anthracite Section, American Institute of Mining and Metallurgical Engineers: fall meeting, Oct. 23, Wilkes-Barre, Pa.
- Illinois Mining Institute: fiftieth annual meeting, Oct. 23, Hotel Abraham Lincoln, Springfield, Ill.
- National Safety Congress and Exposition: Oct. 27-29, Sherman, LaSalle and Morrison hotels, Chicago (postponed from Oct. 2-4).
- Coal Mining Institute of America: annual meeting, Dec. 10 and 11, Fort Pitt Hotel, Pittsburgh, Pa.

were companies organized to manufacture phenolic resins, and prior to World War I, American production of phenol was in the order of only 1,000,000 lb. annually. In 1941, however, some 130,000,000 lb. was produced, with the plastics industry limited, by compulsion, to consuming about 75 percent of this volume.

"Today phenol also serves as intermediate for nylon, while coal tar supplies benzol for conversion into styrene, one of the essential components of the Buna S synthetic rubber that is of such paramount importance to the prosecution of the war."

Coal also serves for the production of water gas, the basal requirement for the manufacture of formaldehyde. Likewise from coke comes acetylene, source of such familiar plastics as Koroseal and Vinylite, which are now going almost exclusively into the war effort.

Rubber in Coal—Threads of vulcanized rubber have been found in German lignites, declared Harry L. Fisher, U. S. Industrial Chemicals, Inc., so its presence in coal may be predicated. The rubber hydrocarbon, which is the chief constituent of natural rubber, has not yet been obtained by synthetic methods, and the expression "synthetic rubber," therefore, can be justified only by the fact that "rubber" has come to mean not merely a particular substance but all materials of a similar nature. Synthetic "rubbers" are, or can be, produced from benzene, phenol, ethylene and acetylene, all of which are obtainable from coal. In the production of all these, petroleum is coal's greatest competitor.

Tires From Coal Products

Rubber for Tires—The synthetic rubber most under discussion at present is Buna S. It is used for tires and, as these are the largest single use for rubber, more of Buna S will be produced than any other synthetic forms of that material. Made from about three parts of butadiene to one part styrene, these substances are copolymerized into large molecules known as "polymers." Butadiene is found in coal gas, but only in such small proportion that it is impractical to isolate it. It can be obtained also from petroleum, natural gas, alcohol and acetylene.

Butadiene also can be obtained by hydrogenating benzene to cyclohexane and then cracking it by heat, forming butadiene and ethylene. Coupled with more benzene, ethylbenzene is produced, which is dehydrogenated to give styrene. This method has been suggested but has not been used, because benzene is needed for other purposes.

Oil-Resistant Rubbers—Perbunan, Chemigum and Hycar are all derived from butadiene and acrylonitrile, which latter is prepared by a series of reactions from ethylene and sodium cyanide. Such rubbers are oil-resistant and are used for gasoline hose, oil hose and gaskets.

Isoprene is a simple derivative of butadiene, one of the products of the dry distillation of rubber. Butyl rubber is made from a copolymer of isobutene to which a very small quantity of isoprene is added. Neoprene is made from acetylene, which comes from calcium carbide and therefore stems directly from coal. Neoprene

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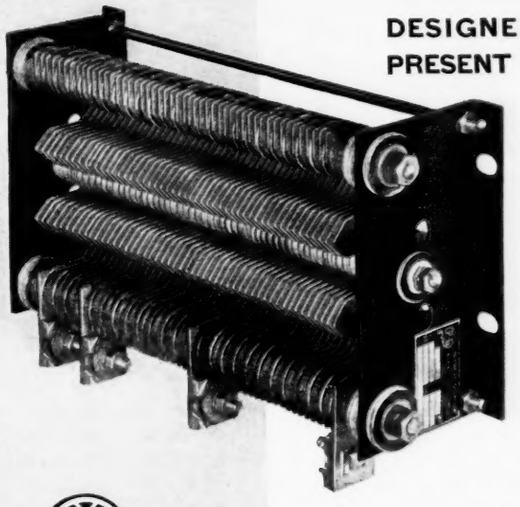

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HERE'S a picture of a track joint which isn't! A Thermit weld has formed the two rail sections into one continuous piece.

The use of Thermit welding for joining rails on main haulage track effects three principal savings: (1) reduced track maintenance, as there are no angle bars, bolts, bonds, no battered rails to repair or replace; (2) lower power consumption, as there can be no leakage of current which occurs in a mechanical joint; (3) increased life of the rail and of rolling stock, as there is no wear or jarring at a joint which isn't there!

THERMIT WELDS FOR REPAIR OF HEAVY PARTS

The breakdown of heavy mechanical equipment can be a serious problem in these days when rapid replacement is almost impossible. Thermit welding is ideally adapted for the repair of heavy parts of stripping shovels, shaker drives, crushers, loading machines, and other equipment used in mine operation.

A Thermit weld is as strong as the casting or forging itself, and the time required for the work is usually a matter of days, rather than the months required for replacement.

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VICTORY NOTE—Tremendous demands for aluminum for war production have caused a temporary shortage of Thermit for rail welding. You will want to keep this ideal rail joint in mind for the future, if you cannot get Thermit today.

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is a polymer of chloroprene and is much like natural rubber in its properties but is more resistant to oils, air, sunlight, heat and coronal discharges. Finally, Thiokol is obtained by the action of sodium tetrasulphide on ethylene dichloride. The ethylene for that dichloride might be made from coal, but, at present, it comes from petroleum and natural gas.

Softeners, vulcanization accelerators, anti-oxidants and many other reagents used in the manufacture of rubber are prepared largely from benzene and naphthalene, which are the chief constituents of coal tar.

Aromatics Made by Dissolving Coal—Those fractions of the byproducts from the carbonization of coal that boil at relatively low temperatures have been the great—and until recently almost the exclusive—source of the aromatic chemicals that the chemical industry finds so useful, asserted H. C. Howard, Carnegie Institute of Technology. Such aromatics are benzene, toluol, naphthalene and phenolic compounds, and some of their derived products are aliphatic and aromatic dicarboxylic acids. Naturally, consideration has been given to the production of these valuable aromatics by some means other than by the carbonization of coal.

Coal Supplies Bitumens

Direct degradation of bituminous coals can furnish good yields of carbocyclic and heterocyclic structures having any desired number of atoms to the molecule. The more complex these structures, the more easy, naturally, it is to produce them. In the presence of certain solvents at temperatures up to 350 deg. C., as much as 80 percent of a bituminous coal can be converted to ash-free "bitumens," condensed cyclic structures of molecular weight ranging from a few hundred to perhaps a thousand units. With mild oxidation, the so-called "regenerated humic acids" are produced, of similar nuclear structure to the bitumens but with sufficient peripheral polar groups to give them acid properties, as is evidenced by their solubility in alkaline reagents and their ability to form salts.

Hydrogenation Produces Other Compounds—More drastic degradation of bituminous coals at 400 to 450 deg. C. when in the presence of hydrogen leads to simple molecular types which, for the most part, are distillable. These are predominantly aromatic hydrocarbons, although significant quantities of naphthenes and paraffins also are present. Under certain conditions, an appreciable part of the oxygen of the coal may appear as phenolic compounds, and of the nitrogen, as organic bases.

Phthalics to Mellitic Acids Formed by Oxidation—Oxidation at elevated pressures and temperatures results in the formation of simple aliphatic acids such as acetic acid and oxalic acid along with aromatic acids of the benzene carbolyc series from the phthalics to mellitic acid and other polycarboxylic acids of more complex nuclei.

Increasing demands of the synthetic chemical industry for aromatic structures may be met by the application of these methods of degradation either to the

bituminous coals themselves or to the complex cyclic structures from coke ovens, the tars and pitches, which for the most part are now either used for purposes of construction or are burned.

Coal for Water Purification—A new field in water conditioning has been opened by "cation exchangers" prepared from bituminous coal, the first satisfactory hydrogen exchange materials that have been prepared, declared Dale Bogard, junior chemist, U. S. Bureau of Mines. The non-siliceous nature of the exchangers prepared from coal makes them particularly useful in softening hard boiler feed water and acid waters.

[A cation (cat-i-on), cathion, kation or kathion is one of a myriad of particles that appear at the cathode of an electrolytic cell or, more broadly, a particle that would so appear if situated so as to be subject to electrolytic action. In water treatment, it may be sodium, magnesium or calcium. Because of its electro-positive character, such cations have the power when combined with certain bodies known as cation exchangers of being exchanged for electronegative ions, anions (an-i-ons) such as carbonic acid, chlorine, the SO_4 radicle or hydrogen.

How Exchanger Works

[The exchanger hands its hydrogen over to the bodies in the hard water which contain anions and which may be, for example, sodium, calcium or magnesium bicarbonate or chloride, and it takes in exchange the sodium, calcium or magnesium which they contain. Thus with calcium bicarbonate the hydrogen unites itself with the oxide of carbon and becomes a carbonate, which is carbonic acid, and the sodium, calcium or magnesium combine with the exchanger as its hydrogen partner leaves. The cation exchanger is later restored by the addition of dilute acid such as sulphuric acid, which provides the hydrogen needed. Thus the cation exchanger is once more ready to work on other water.

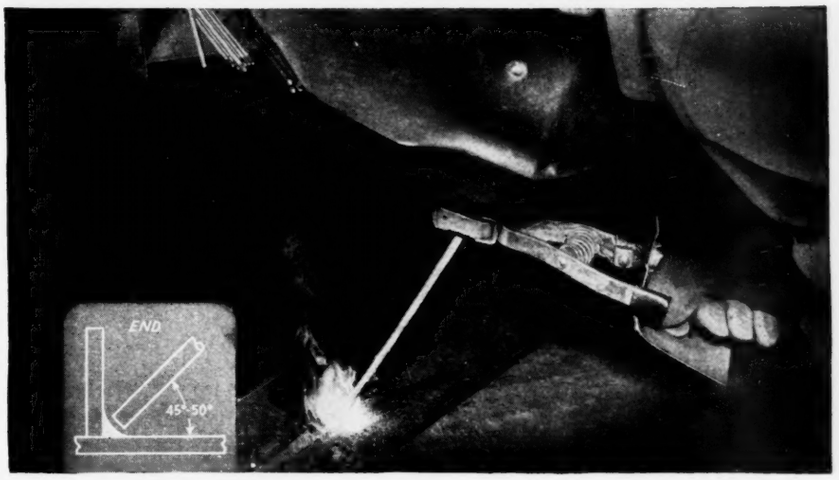
[At the same time, the sulphuric acid turns the sodium, calcium or magnesium compounds to almost insoluble sulphates, which stay with the exchanger and have to be rinsed out to restore its condition. The water thus purified passes off, containing only the anions—carbonic acid and chlorine. The carbonic acid, H_2CO_3, breaks up into water and carbon dioxide and is removed in a degasifier. As a result, the water to a considerable extent is de-mineralized, and the cation exchanger is ready to work on other water. The action may be exemplified by the action with calcium bicarbonate.

H_2.Coal + Ca $(HCO_3)_2$ = 2 H_2CO_3 + Ca.Coal

Ca.Coal + H_2 SO_4 = H_2.Coal + $CaSO_4$

[However, the coal used is not raw but 14×20-mesh coal that has been digested with concentrated sulphuric acid for some hours, washed, and autoclaved with dilute sodium hydroxide.]

The cation exchanger will combine with hydrogen when regenerated with a dilute acid, declared Dr. Bogard and will combine with sodium when in a sodium-chloride solution. High sodium content



how a ten-year-old technique

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THIS photograph shows a method taught by Murex Engineers for more than ten years and used by many experienced welders to speed fillet welding. It also saves up to 40% of the weld metal, produces a substantially stronger weld and at the same time helps to conserve precious welding electrodes.

First: The electrode is held at an angle of 45° to 50° to the horizontal plate and leaning in the direction of welding to form an angle of about 20° with the vertical.

Second: In multiple pass work, beads are laid from the bottom upward—not from the top downward.

Third: Cleaning time can be saved by leaving on the slag until each layer of beads is completed.

Fourth: Select a rod which permits the use of high current and use the largest size electrode that is practical.

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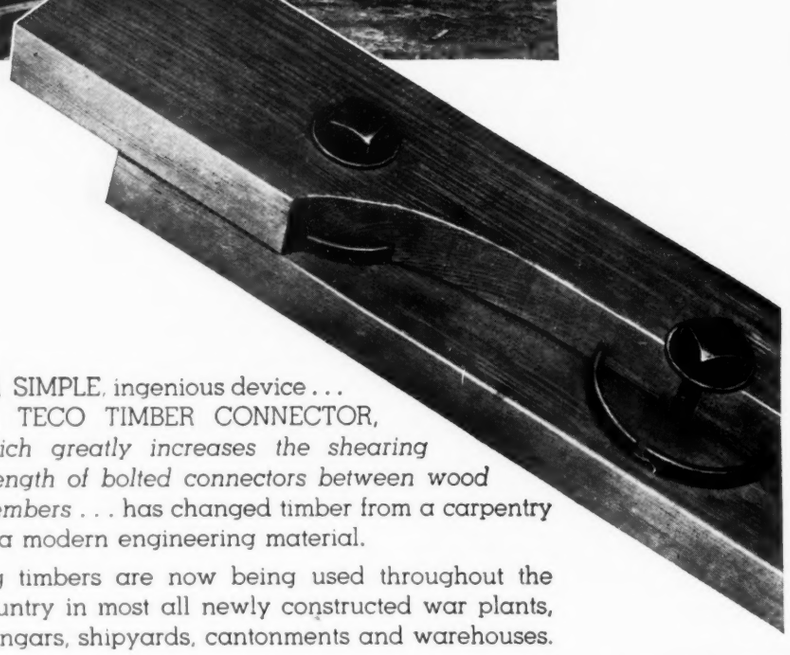
Engineered TIMBER is the new heavy construction MATERIAL

TECO's great progress in engineering timber to heavy construction is a boon to wartime architects & engineers . . and TECO structural advantages will help to rebuild the world tommorrow!



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★ WASHINGTON, D. C. PORTLAND, OREGON ★

in the raw water will temporarily decrease the capacity of a carbonaceous hydrogen exchanger. There is a secondary exchange mechanism between the sodium and the hydrogen exchanger that does not occur when the raw water contains no sodium. Dilute solutions of copper ions that otherwise would be wasted can be concentrated on a carbonaceous exchanger and removed with a small volume of regenerating acid. Active chars suitable for removing odors and tastes from potable waters can be prepared from coal or coal refuse.

Coal, Source of Synthetic Plant Hormones—Hormones, said H. G. Guy, research department, Koppers Co., are regulators of plant growth that enable fruit to grow without fertilization, and cuttings to develop roots and that prevent fruit from dropping off the tree prematurely. They can be produced synthetically from naphthalene, a byproduct of coal carbonization, and their use may make farming more of a science and less of an art than at present.

Carbonizing for Agriculture

By carbonization in byproduct ovens, observed Dr. Guy, many materials useful in agriculture are produced from coal, which are sources of fertilizers, insecticides, disinfectants, herbicides, fungicides, fumigants, preservatives and food dyes. Ammonium sulphate, derived from coal in the byproduct oven, is still in this country the standard source of nitrogen for fertilizers, because of its low cost per unit of available nitrogen, a fundamental need of plant life. Its production has made the American farmer independent of foreign sources for this essential food. Cyanogen from coke-oven gas, following conversion to ammonium thiocyanate, is converted into products that tend to make this country independent of foreign supplies of pyrethrum and rotenone.

Other Farm Uses—Over 16,000,000 lb. of naphthalene is used for agricultural purposes. It preserves hides in storage, destroys the lice on cattle and hogs and gives protection against certain greenhouse pests. Used on the soil, it controls the carrot rust fly.

Through the use of coal-tar dyes, farmers have been able to make their products more attractive to the consumer who frequently selects his food on the basis of appearance. These dyes are the most important food-coloring materials and are uniform, dependable and safe. The tar-acid oils, chlorobenzenes, chlorophenols and the recently discovered diphenylamine and phenothiazine, Dr. Guy stated, are useful for preservation of wood, destruction of parasites and as general disinfectants.

The agricultural consumption of synthetic compounds, he added, has increased steadily and should continue to do so in future years. Through use of these chemicals, farmers have been able to increase the yield and quality of their products. Increased consumption of synthetic chemicals should result in increased use of the chemicals derived from coal. These coal derivatives will serve both as final products and as raw materials in the manufacture of new and more effective agricultural chemicals.

Dyes Made Directly From Coal—Treatment of bituminous coal with nitric acid converts the reactive carbonaceous constituents into a nitrated and oxidized substance from which various dyes are obtained by use of organic acids and inorganic alkalis, a comparatively cheap, easily performed, efficient, readily controlled operation that requires no complicated, expensive apparatus, asserted H. B. Chambury, C. C. Wright, A. W. Gauger and J. R. Lotz, Pennsylvania State College, in a paper entitled "Dyes Directly From Coal."

The dyes can be used for the direct coloring of protein fibers such as silk and wool, cellulose fibers such as cotton, jute and linen and synthetic fibers such as nylon, producing various shades of brown. They have been tested on silk and wool, using standard textile methods, and were found to be unaffected by water, washing, perspiration, cross-dyeing, crocking and acidity. They are not fast to bleaching, which is not an essential characteristic, or to light. In the presence of sunlight, the shade darkens within the first three hours and then remains constant.

Furfural, the Almost Complete Coal Solvent—By oxidation in three stages, declared a paper by Walter Fuchs, T. S. Polansky and A. G. Sandhoff, Pennsylvania State College, bituminous coal is transformed into furfural-soluble substances with a yield of 90 percent or more of the coal substance. The furfural solutions may be considered as binary systems of two completely miscible substances. Separation of furfural and ash-free carbonaceous material may be accomplished in many ways.

Anthracite Makes Filter

Why Anthracite Makes a Good Filter—Being essentially a carbon and therefore more nearly chemically inert than any of the other substances used in filters, Pennsylvania anthracite, asserted H. G. Turner, Anthracite Equipment Corp., is well suited for use in many filtration processes. Its shell-like fracture produces a particle of the most desirable shape for filter use; its low specific gravity and angled surfaces make it possible to run the filter long without cleansing, and enable the filter bed to be washed effectively at lower back-wash rates, increasing filter capacities from 25 to 100 percent.

Anthracite as "Anthrafilt" is used in municipal filters, also in the filters of power plants, for softening waters by the hot process and for oil removal from boiler condensates. Filters for swimming pools, for chemical clarification and for sewage also use Anthrafilt. In its preparation, low-ash material of the best particle shape is selected with care; the most important factor is to obtain the particle size best suited to filter use and design.

Blending Coking Coals—No single available coal seam in Alabama will produce a coke with all the qualities desired for foundry use, asserted W. M. Mobley, Alabama By-Products Corp. One coal seam, low in ash and sulphur, yields a coal that makes a coke that is too soft and spongy, whereas another produces a coal that forms a hard firm coke but one that has too many impurities. For

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★ To avoid production delays because of track equipment failure, we urge you to inspect your haulage roads regularly, note those small items that may fail, and order them accordingly so there will be no halt to vital coal output. We can assure the delivery of these small parts now, that you will need in the future . . . So, NOW IS THE TIME TO ACT . . . TO PREPARE FOR THE FUTURE . . . TO CONSERVE YOUR TRACK EQUIPMENT BY PROPER MAINTENANCE. Write us, listing items you need . . . or, call in the West Virginia Rail engineer and go over your track equipment with him—he'll point out the weak spots and make repair recommendations.

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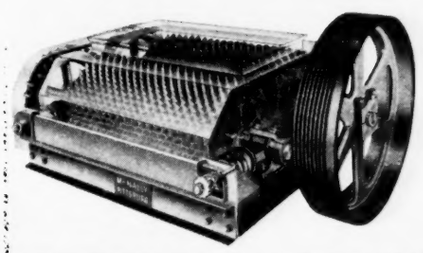

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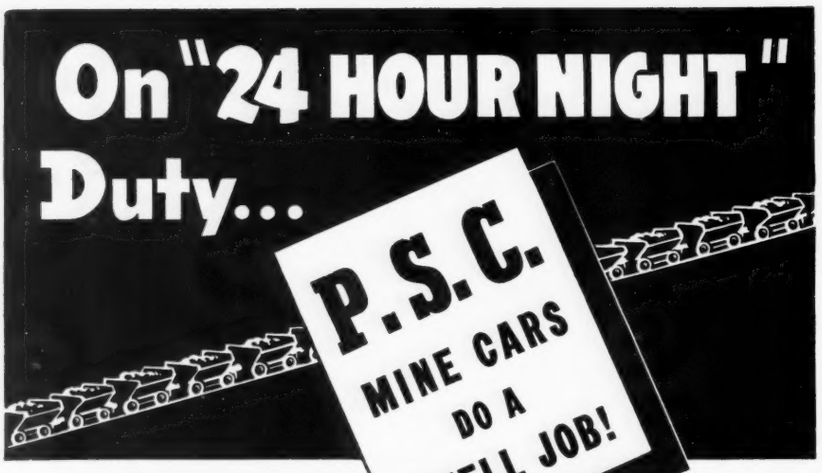
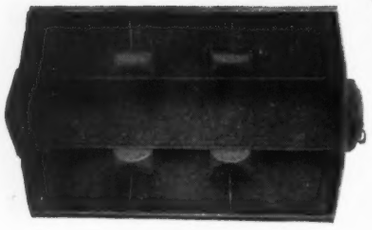
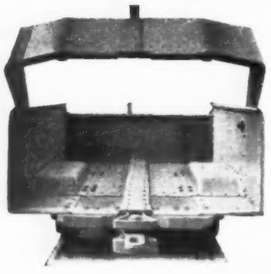


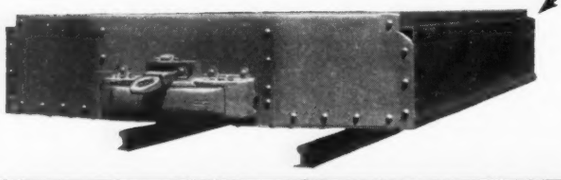


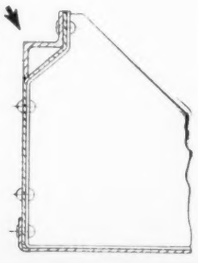
Ruggedly built for *three shift* production, P.S.C. All-Steel Mine Cars are moving maximum loads every hour around-the-clock. Special types developed for underground and open pit mining provide uninterrupted heavy duty service with minimum maintenance.

Let our engineers make a recommendation on the type best suited for your requirements. Bulletin 66 sent on request.



Note the exclusive design feature of this Low Height Rotary Dump Car—Combination flanged side sheet and heavy "Z" bar, provide rugged top chord construction, with shelf for holding car in dump. Top leg of "Z" bar is riveted and bottom leg is welded to side plate.





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this reason, the most suitable coals are blended so as to balance the bad features of one against the good qualities of another.

Loss of Caking Quality in Storage—Long before storage or oxidation reduces the true heating value of coal 1 or 2 percent, the caking tendency of the coal may be reduced greatly, asserted a paper by L. D. Schmidt, J. L. Elder and J. D. Davis, U. S. Bureau of Mines.

Four-hundred-pound samples representing fifteen different coal beds were oxidized progressively in an accelerated weathering apparatus and then were subjected to a series of tests to determine the changes in their coking and caking behavior.

One coal sample lost its coking power under standard oxidizing conditions in one-sixteenth as much time as another sample. In other words, "durability of coking power" had a range of 16 to 1. With most coals, this durability by the method developed can be predicted with fair accuracy from their analyses. Loss in caking tendency, an important characteristic in planning ways to improve the performance of underfed stokers, was determined by several different tests.

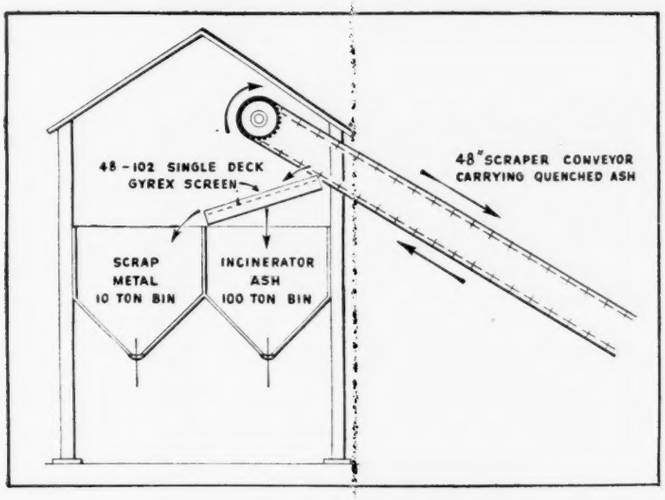
Coke Strength Indicators

Comparisons showed that (1) decrease in agglutinating value will predict a decreased strength of coke, (2) the quantity of unfused char remaining in the retort after carbonization is correlatable with the strength of the coke from which it is formed and also with the agglomerating index as based on the classification of the coke buttons made in the standard volatile-matter test.

Swelling of Coal in Caking—British swelling index values decrease when coal is exposed to oxidation, according to a paper by O. W. Rees and W. F. Wagner, Illinois State Geological Survey. Samples were exposed up to eight or nine months and tests made at various intervals. Agglutinating values were determined occasionally to demonstrate that the coal was oxidizing. Three sets of whole coal and its separate banded ingredients representing high-volatile bituminous coal of ranks A and C were studied. The results indicated that oxidation did not influence greatly the ignition temperatures of the samples under observation.

Coal's Desire for Oxygen First Rises and Then Falls—Does coal in the mine and in storage continue to gather oxygen indefinitely? G. R. Yohe and Myron H. Wilt, Illinois State Geological Survey, testing for the reactive oxygen in Illinois No. 6 coal and in the clarain, durain, fusain and vitrain fractions therefrom, found two periods of maximum avidity for oxygen and also that after a month or so the desire to adsorb such gas decreases. The reactive oxygen was measured by the oxidation of titanous chloride and the changes in oxidizing power with time was measured and plotted for about three months.

For the whole coal the curve reached a maximum in 11 days, then fell slowly, but the clarain curve showed two maxima, one at 14 and one at 53 days; fusain also two, one at 8 and another 46 days with



Pittsburgh Salvages 10,000 tons of Scrap —and nets $60,000

Robins engineers and machinery often participate in interesting installations. Many of them are unusual, some actually unique. One in the latter classification came up recently in Pittsburgh. Mr. D. C. Agar, Managing Engineer of the Bureau of City Refuse, wanted to salvage the scrap in city residue agglomerate. The screening methods used in coke plants seemed a logical and economical method of separation.

■ A suspended-type Robins GYREX Vibrating Screen was installed where it would receive material from the final scraper conveyor . . . at a total cost considerably less than $5,000.

■ At the present rate of recovery (and current contract selling-price) the City of Pittsburgh is recovering 10,000 tons of scrap for the war effort . . . and will net $60,000 a year from the salvaged metal.

■ Robins engineers are at your disposal for advice regarding economical efficient applications of screens and materials handling machinery.

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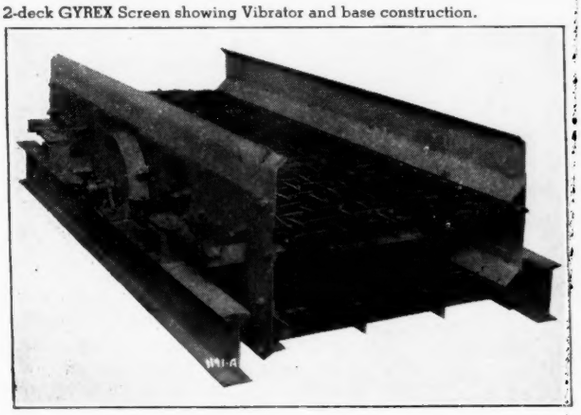
2-deck GYREX Screen showing Vibrator and base construction.



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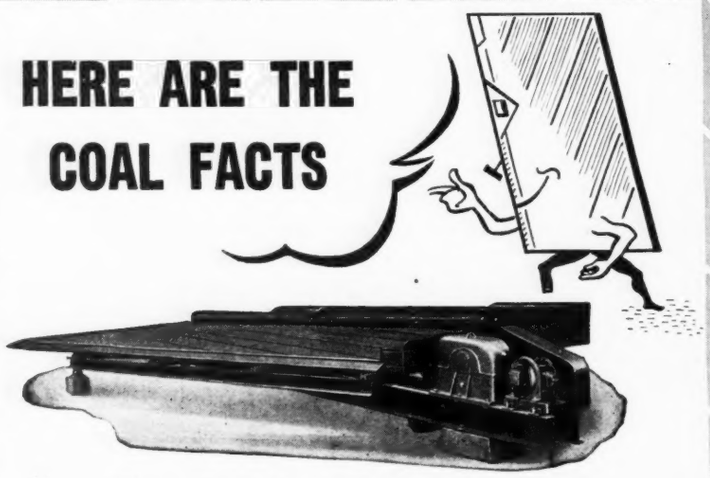

"Plenty of valuable, marketable good coal is sent to the refuse pile every day when old-fashioned washing methods are used. But when I'm on the job you can be sure your raw coal yields the maximum GOOD coal."

SuperDuty Diagonal Deck Coal Washing Tables with their extra riffles and separation area give you large savings in recoveries. They answer the demand for greater war production. Step up YOUR daily production by taking advantage of the increased washed coal output and reduced refuse losses made possible by these tables. Save valuable time and labor, as well as money, with SuperDuty Tables. Investigate the many advantages — today.

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a lesser peak at 33 days; and vitrain two distinct peaks at 12 and 26 days respectively, with a smaller one at 47 days. After about 60 days the curves for whole coal, clarain and vitrain fell to nearly zero, whereas those for durain and fusain after 82 days still showed appreciable oxidizing power. A weighted composite curve prepared from the data for the four banded ingredients agreed well with the curve determined experimentally for the whole coal.

Cement Has Specific Coal Preferences—Though some of the coal entering a cement plant is used for power generation and the drying of raw material, the rotary kilns for burning the product receive most of the coal, asserted J. C. Witt, Marquette Cement Mfg. Co. As a part of the ash remains in the product, the average ash content, its range from minimum to maximum and its chemical composition are important as well as its heat value. Sulphur is undesirable because more fuel must be added to provide for its removal. Coal too low in volatile content is not satisfactory for cement burning.

Corrosion of Metals by Flue Gases—A wide range of susceptibility to corrosion attack was shown by 18-8 chrome-nickel steels, depending on their source and previous treatment, declared Louis Shnidman and Jesse S. Yeaw, Rochester Gas & Electric Corp. The low carbon content of 18-8-S samples apparently had no influence on the eventual rate of corrosion. Fractions of titanium and columbium did not impart resistance to 18-8 steels when exposed for two years to flue gases but a fraction of molybdenum did. Chrome-nickel (25-12) showed low susceptibility, but an increase in nickel to 20 increased the rate of attack.

When Does a Flame Leave the Burner?—A flame, answered Bernard Lewis, U. S. Bureau of Mines, and Guenther von Elbe, Carnegie Institute of Technology, rests on the orifice of a burner because at the base of the inner cone the velocity of burning, as modified by the quenching of the explosive reaction by the rim and by interdiffusion with the surrounding atmosphere, is equal to the gas velocity in that part of the stream. This condition is maintained over a range of flow velocities, below which flashback, and above which blowoff occur.

•

Tips to Consumers of Coal In Hand-Fired Heaters

To assist American householders who heat with hand-fired units burning bituminous coal, members of the staff of the department of mechanical engineering of the University of Illinois recently made an intensive study to determine means by which the best possible results might be obtained from such equipment. Findings disclosed by this study are embodied in Circular No. 46 of the University of Illinois Engineering Experiment Station, prepared by Prof. A. P. Kratz, Asst. Prof. J. R. Fellows and John C. Miles.

Included are many suggestions which will help operators of hand-fired furnaces, boilers and stoves to achieve maximum

Bureau of Mines Approvals

Three approvals of permissible equipment were issued by the U. S. Bureau of Mines in August, as follows:

Jeffrey Mfg. Co.—Type 61 power unit for conveyors; 15-hp. motor, 230 volts, d.c.; Approval 455; Aug. 13.

Goodman Mfg. Co.—Type No. 163 "tractor truck"; two motors, 10 and 1½ hp; 250 volts, d.c.; Approval 456; Aug. 19.

Goodman Mfg. Co.—Type 95-16 belt conveyor; ¾-hp. motor, 230 volts, d.c.; Approval 457; Aug. 20.

heating comfort while minimizing smoke, dust and other disagreeable features. The circular may be obtained without cost by writing to the Engineering Experiment Station, University of Illinois, Urbana, Ill.

•

Coal Festival Inaugurated At Central City, Ky.

The first annual Western Kentucky Coal Festival was held Sept. 7 at Central City with a parade through the business section of the city, terminating at the baseball park. The program included the selection and crowning of a festival queen. A number of contests were held including a coal-loading event in which local unions sponsored coal-loader groups.

Garfield Lewis, Scranton, Pa., international executive board member, United Mine Workers of America, and Ed. Morgan, president, district 23, U.M.W.A., made the principal Labor Day addresses. Mayor S. O. Sears and County Judge J. E. Wood welcomed the visitors.

•

W. H. Warner Jr. Heads New Mining Firm

The Warner Coal Corporation, of which Whitney H. Warner, Jr., is president, has been formed to take over operation of the Richland & Costanzo Co. mines of the Wheeling Coal Co. and the Wheeling Valley Coal Corporation. Headquarters of the new organization are in the Union Trust Building, Cleveland, Ohio. The operations, which are in the Warwood (W. Va.) area, produce about 750,000 tons annually from the Pittsburgh No. 8 seam, which will be marketed under the trade name "Warwood."

Other officers are Ralph S. Geddes, executive vice-president; K. B. Whitworth, treasurer, and Walter C. Adams, secretary. Messrs. Warner, Geddes and Whitworth will compose the executive committee.

•

Roden No. 3 Gets Going

No. 3 slope of the Roden Coal Co., Marvel, Ala., resumed operation in the third week of September with an initial output of 50 tons per day. Production is to be increased as rapidly as possible—to

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Long life is built into *Genuine Flexipipe.* It is made of a tough specially woven, treated material that resists damage from gas, fungus growth, heat, acid and alkaline waters. It has strength to stand up under hard usage.

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THE bituminous industry is pretty well sold on the need for dust-treating coal. The question then is, "What is to be the dust-preventive agent?"

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potential capacity if necessary. This operation, in the Clark seam and idle for many years, has been in process of rehabilitation for several months.

•

Hickory-Nut Harry to Dethrone Appleseed Johnny?

Emulating the example of Jonathan ("Johnny Appleseed") Chapman, Harry Hyatt, director of conservation for the Indiana Coal Producers' Association, bids fair to go down in history as "Hickory-Nut" Harry. A few years ago he started picking up hickory nuts while on jaunts over strip-mined areas. After filling his pockets with these nuts he would drop them in selected spots on the barren strip hills and carefully cover them with earth. He estimates that he has planted upward of 25,000 of these nuts in soil uncovered by stripping shovels.

Director Hyatt on the Job

An Indiana law provides that mine operators are to plant an acre to trees for each acre mined by the open-cut method, and Mr. Hyatt, at the behest of the producers' association, helps in this work.

•

Sane Smoke Control Program Adopted for Cincinnati

An ordinance on smoke abatement containing many of the features advocated in testimony on the subject by the Metropolitan Smoke Control Committee has been passed by the City Council of Cincinnati, Ohio. The testimony, according to a statement by Appalachian Coals, Inc., covered 263 pages "which not only showed the fallacy and impracticability of the St. Louis-type ordinance but pointed the way to a sane, sensible smoke-abatement program."

Passage of the Cincinnati ordinance, said the A.C.I. statement, has written "an end to a bitter fight to foist a St. Louis-type ordinance on the unsuspecting people of Cincinnati. This is the third city

where the coal producers' smoke committee for smoke abatement, by the presentation of incontrovertible evidence on a sound engineering basis, has convinced city officials that its program for smoke abatement is preferable to an attempt to perform a 'miracle' by prohibiting coal, as was tried in St. Louis. The other two cities are Atlanta, Ga., and Nashville, Tenn."

•

Safety Education Is Started By New Colorado Institute

With chapters meeting in almost every district, the newly organized Colorado Coal Mining Officials' Institute is getting its fall program under way. About 30 persons attended a State meeting held Aug. 1 in the Shirley-Savoy Hotel, Denver, when an executive committee of five was elected. This committee will adopt an educational program to be used throughout the State. The committee includes: Albert Jones, Coal Creek; Thomas Greenhalgh, Haybro; Thomas Hilton, Lafayette; A. P. French, Delcarbon, and Harry Swihart, Serene.

Subjects discussed at recent district meetings are: Palisade district, "Haulage Accidents"; Southern Colorado mines south of Trinidad, "Mine Squeezes" and "Timber Extraction"; Boulder County, "Mine Fires Successfully Handled"; Weld County, "Gases in Gob Areas"; Fremont County, "Proper Car Blocking to Prevent Runaways"; Aguilar district mines north of Trinidad, "Breakdown in Haulage Accidents."

•

Personal Notes

RUSSELL BATEMAN, formerly section foreman with the Koppers Coal Co. at Portage, Pa., is now general foreman with the Yorkshire Coal Co., Madera, Pa.

O. C. CASTEEL, formerly inspector at No. 4 mine of the Pond Creek Pocahontas Co., Bartley, W. Va., has been named inspector by the Marianna Smokeless Coal Co., Marianna, W. Va.

W. B. COMBS, formerly mine foreman at No. 4 mine of the Pond Creek Pocahontas Co., Bartley, W. Va., has been promoted to mine inspector.

B. W. DERINGER, for the last two years a principal price examiner with the Bituminous Coal Division, Washington, D. C., resigned as of Sept. 5 to accept a position with the Central Pennsylvania Bituminous Coal Producers' Association, Altoona, Pa. He is to be in charge of the victory production drive, a joint undertaking of the operators, miners, War Production Board, Manpower Board and Selective Service to increase production of bituminous coal in District 1 necessary in the country's war effort. CLARENCE DONALDSON, vice-president of District 2, United Mine Workers of America, will be associated with Mr. Deringer in this work.

FRANK W. EARNEST JR., president, Anthracite Industries, has accepted the hon-

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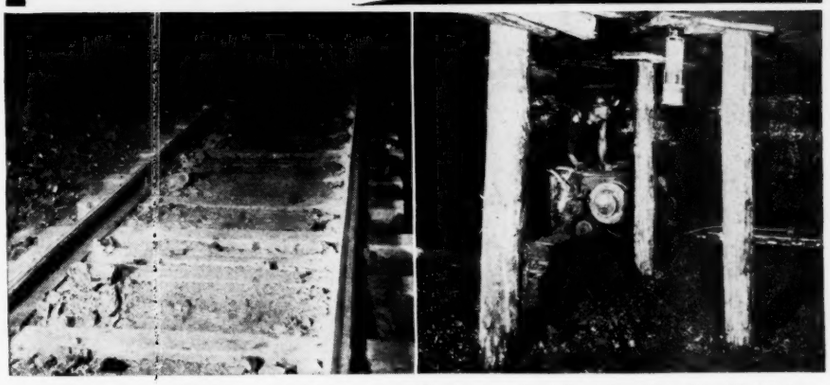

(Left) Osmose-treated oak ties in haulage way of Clover Fork Coal Co. Mine, Kitts, Ky. (Right) Posts, caps, wedges Osmose-treated in Alabama Mine, give 3 to 5 times longer service.

How Osmose-Treated Mine Ties and Timbers cut maintenance and replacement costs

Mining companies throughout the country are using Osmose-treated ties and timbers because they have a service life three to five times longer than untreated timbers thus cutting maintenance and replacement costs 300 to 500%. Easy to apply by dipping or brushing, Osmosalts penetrate into the wood forming a deep zone of protection that resists wood decay and prevents rot. Because Osmose-treated timbers keep their original strength, they provide additional safety by helping to prevent serious, costly accidents that often result from untreated decaying timbers. Our field engineers are available, for consultation on your wood-preserving problems. Ask for his services.

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2. PROVIDES 3 to 5 times longer service life over untreated timber because Osmosalts penetrate deeply into the wood.

3. ELIMINATES capital investment in treating equipment and also does away with transportation charges to and from pressure treating plants.

4. ENABLES you to treat your own timber with unskilled labor by simply brushing or dipping.

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GENERAL ELECTRIC

orary vice-chairmanship for the Anthracite industry of National Bible Week, Oct. 12-18.

J. M. FARLEY, formerly section foreman at No. 4 mine of the Pond Creek Pocahontas Co., Bartley, W. Va., has been promoted to mine foreman, vice W. D. Combs, advanced.

HOWARD A. GRAY, formerly Acting Director of the Office of Solid Fuels Coordinator for war, has been made Deputy Solid Fuels Coordinator for War. DAN H. WHEELER, formerly Acting Director of the Bituminous Coal Division, has been made director of that division. Secretary of the Interior Harold L. Ickes is the Solid Fuels Coordinator. Prior to being appointed Acting Director in the Office of Solid Fuels Coordination Mr. Gray was Director of the Bituminous Coal Division. Mr. Wheeler was Assistant Director of that agency. Both men have held executive positions in the Federal Government for a number of years.

JOHN HILL has been named a safety director by the Consolidation Coal Co., with office in Jenkins, Ky.

R. J. HOWARD, Jenkins, Ky., has been made district engineer by the Consolidation Coal Co., assuming the position left vacant by the resignation of L. E. Kelley, who has joined the Red Jacket Coal Co., Red Jacket, W. Va. Mr. Kelley had been division or district engineer for Consol for many years.

WILLIAM M. LACEY has resigned as superintendent of the Sayreton mines, Republic Steel Corporation, Sayreton, Ala., to accept a connection with the McAlester Fuel Co., McAlester, Okla.

RICE W. MILLER, president, Nokomis Coal Co., Nokomis, Ill., where he resides, was nominated on Sept. 21 on the Republican slate for State Senator from the 38th Illinois district.

D. K. SCOTT, hitherto superintendent of the mechanical department, Pond Creek Pocahontas Co., has been appointed superintendent of No. 4 mine, Bartley, W. Va., vice H. A. JONES, resigned.

W. C. SHANK, of Johnson County, Kansas, has been appointed War Production Board regional director with headquarters in Kansas City, Mo. Region No. 7, centering in Kansas City, comprises the states of Arkansas, Kansas, Missouri and Nebraska. Mr. Shank is president of the Crowe Coal Mining Co., Kansas City, Mo., and a director of the National Coal Association.

A. D. SISK, Pikeville, Ky., has been reelected secretary of the Big Sandy-Elkhorn Mining Institute, a position he has held for many years.

ERNEST STEPP, assistant superintendent of the mechanical department, Pond Creek Pocahontas Co., Bartley, W. Va., has been made superintendent, vice D. K. Scott, promoted.

E. E. THACKER, Kingport, Tenn., for-

merly connected with the Holston Ordnance Works, has been appointed personnel director of the Eastern Coal Corporation, Tierney Mining Co. and the Premier Pocahontas Collieries Co. Identified with bituminous coal production for 27 years, Mr. Thacker will have headquarters in Bluefield, W. Va.

R. B. WATTS has been appointed superintendent of the Sayreton mines, Republic Steel Corporation, Sayreton, Ala., vice William M. Lacey, resigned. Mr. Watts was formerly superintendent of Edgewater mine, Tennessee Coal, Iron & Railroad Co., Pratt City, Ala.

J. WILLIAM WETTER, president, Rockhill Coal Co., Philadelphia, Pa., has accepted the honorary vice-chairmanship for the bituminous coal industry of National Bible Week, Oct. 12-18.

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Welding Handbook Takes On New Significance

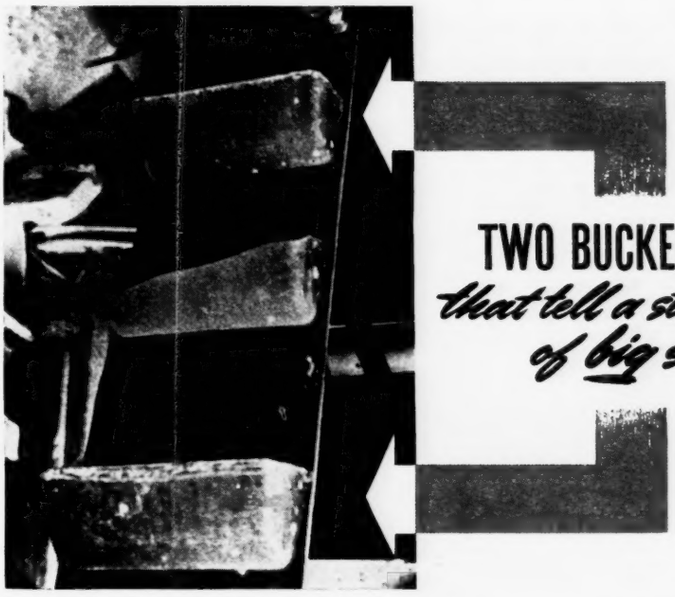
Greatly enlarged, the seventh edition of the "Procedure Handbook of Arc Welding Design and Practice," published by the Lincoln Electric Co., Cleveland, Ohio, takes on a new significance this year. The nearly 300 authors have endeavored to provide as much complete and up-to-date information as possible to help men in the shops, shipyards, airplane factories, ordnance plants and other industries produce to the fullest extent.

More fully than ever before the book explains the various methods and techniques used in welding, with a view to speeding up welding design and engineering and to make it easier for the thousands of men in training to learn the essentials of welding in the shortest possible time. The book contains 1,308 pages, 6x9 in.; 1,810 illustrations, both halftones and drawings; semi-flexible simulated leather cover, gold embossed; price postpaid in the United States, $1.50; elsewhere, $2.

•

Bootleg Holes Close Down But Some Legitimize

Coal from 867 former bootleg coal holes now goes under contract to legitimate breakers and 280 holes are closed, at least temporarily, but 483 still send their stolen product to "bootleg breakers" in the anthracite region of Pennsylvania. Thus, as of Sept. 12, there were 1,350 active independent coal holes, legitimized or bootleg, whereas on March 1 of last year there were 3,006, all illegitimate. In the last three months, 280 holes, bootleg and legitimate, have ceased operation, but the proportion of the holes delivering to legitimate breakers has risen from 53 to 64 percent in that time. At the start, 100 percent of the production was bootleg coal. Some of the holes are being driven from old strippings into coal left to support highways, thus destroying roads and jeopardizing travel.



TWO BUCKET LIPS
that tell a story of big savings

VISIBLE PROOF of the time and money saving merits of Stoody hard-facing alloys is illustrated by this photograph of conveyor buckets.

In a large rock crushing plant two alternate bucket lips were hard-faced with Stoody Self-Hardening and the balance of the buckets left unprotected. After operating for several months, the unprotected lips were worn as shown, while the hard-faced lips were good as new. Besides lasting 3 times longer the hard-faced buckets continued to carry a full pay load, while unprotected buckets lost a considerable proportion of their original capacity. When the hard metal is finally worn away the application can be repeated as required.

A special plant shutdown is not necessary to hard-face the bucket lips, since any welder can do the job on the spot and during a normal shut-down period. Cost of the hard metal averages only 25c per bucket and the application requires less than 10 minutes.

Cut your maintenance costs by hard-facing crushers, pumps, undercutter bits, augers, loaders, mining machines, etc. Our engineering department will be glad to furnish recommendations on your wear problems.

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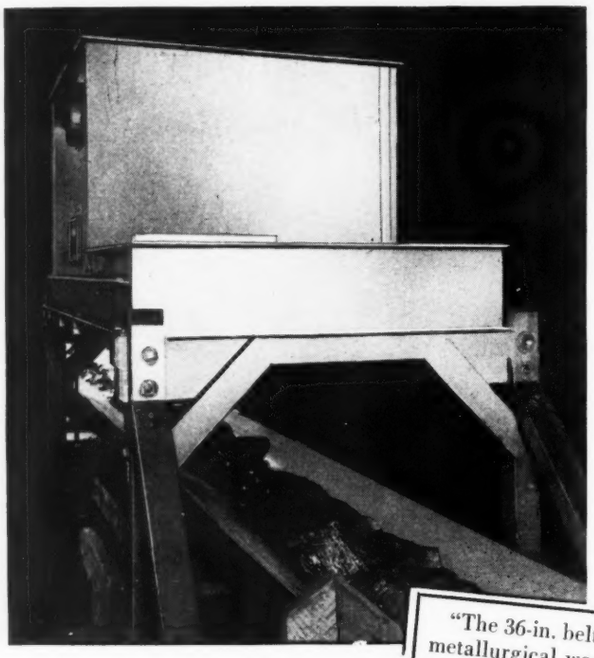
WEIGHTOMETER



From article in COAL AGE AUGUST 1942

How to do
A Better Washing Job *with* **Greater Ease . . .**

"The 36-in. belt conveyor feeding the metallurgical washers includes a Merrick Model E Weightometer, which is part of the original 1938 installation. Its job was to record the feed over a given time. The instantaneous readings provided by this scale are a function of the percentage of refuse in the feed because the bin blending feeders supply a constant volume to the belts. A Merrick Rateograph indicator of the dial-type was added to the unit and placed near the operator's station along with a graphic recorder with circular chart. This indicator and recorder were installed primarily to assist in maintaining a uniform feed to the wash boxes; however, they have proved of great value in showing the operator the fluctuations in percentage of refuse in the raw-coal feed, thereby enabling him to do a better washing job with greater ease."

● **WEIGHTOMETERS may be applied to existing belt conveyors or furnished complete with short pivoted conveyor.**

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Independent First-Aid Meet Won by Pompey No. 1

Pompey Coal Co.'s No. 1 team, Jessup, Pa., with 99.90 points, took first place at the third annual first-aid contest of the Northern Independent Anthracite Operators, held Aug. 1 at Heart Lake, Pa. DeAngelis Coal Co.'s No. 1 team, Carbondale, was second, with 99.75; Nardelli Coal Co., Blakeslee, and Northeast Coal Co., Carbondale, tied for third, with 99.65, the first named winning on the toss of a coin. Ben L. Stone, Childs, presided at the meet and Joseph Nardelli was general chairman.

Richard Maize, State Secretary of Mines, who presented the awards, commended all the miners on their first-aid activities. In discussing the anthracite miners' part in the war effort, he urged all workers to report for work every day. L. F. Weichel, executive secretary of the Anthracite Operators' Association, who was present, said the teams were so well matched that it was difficult to select the best.

R. J. Warnke, U. S. Bureau of Mines, Washington, D. C., presented the Sentinels of Safety trophy, donated by *Explosives Engineer*, to the Eddy & Joe Coal Co., Simpson, Pa., for its safety record in 1941.

•

John A. Howe, Truax-Traer, Dies

John A. Howe, 54, executive vice-president of the Truax-Traer Coal Co., Chicago, died Sept. 2 in Passavant Hospital, Chicago, after a protracted illness from heart disease. He had been with the Truax-Traer organization since 1931. At the age of 22 he made his entry into the coal business as an employee of the Carnegie Dock & Fuel Co. in Minneapolis. When he left the company in 1931 after 21 years of service to become executive head of Truax-Traer he was Carnegie president.

He was a director in Appalachian Coals, Inc., which he helped to organize, and in Bituminous Coal Research. He was one of the leading representatives of the bituminous mine operators at the hearings held in Washington in connection with the national bituminous coal legislation passed by Congress in 1937.

•

Vinton Mines Taken Over

A new company, the Vinton Coal & Coke Co., was organized as of Sept. 1 to take over operation of Vinton Nos. 1 and 6 mines, Vintondale, Pa. Officers of the new company are C. M. Schwerin, Jr., president; Robert M. Fisher, vice-president, and Don A. Martin, secretary and treasurer. The old operating company was known as the Vinton Colliery Co.

•

Starts Supplementary Unit

Pyramid Coal Corporation has begun construction of an underground slope mine as a supplementary coal-producing unit. This addition is at its Pinckneyville (Ill.) property.

Locust Coal Trains Mechanics For War Industries Jobs

To further the war effort, the Locust Coal Co., Shenandoah, Pa., has donated the use of the company's shop and tools for five days a week from 4 p.m. to 12:30 a.m. to serve as a vocational training school for national defense. The school sessions are for eight hours with one-half hour for supper. Four hundred hours is necessary for graduation.

Since the school was started 102 men have been graduated. Some are now employed at the Brooklyn Navy Yard, some by the Midvale Steel Co., others by the Wright Aeronautical Corp., the Tank Division of the American Car & Foundry Co., the Sun Shipbuilding & Dry Dock Co., the Cramp Shipbuilding Co., in Philadelphia, and the Baldwin Locomotive Works. The Federal Government pays for all material, and none of the product of the students' labors is available to the company. Fifty percent of the students receive governmental pay while studying, 25 percent are workers on relief and 25 percent are voluntary students. Two men of the voluntary group passed the 400-hour course and entered the employ of the coal company as machinists.

H. F. Brecker, mechanical engineer, Locust Coal Co., and Adolph Androlonis, appointed by the school district, are the certified instructors. Students are not required to have any qualifications prior to training. In all, the course has been given six times, with 16 to 22 persons in each course.

•

Coal-Mine Accident Fatality Rate Resumes Upward Trend

Accidents at coal mines of the United States causes the deaths of 101 bituminous and 21 anthracite miners in July last, according to reports furnished the U. S. Bureau of Mines by State inspectors.

With a production of 47,700,000 net tons, the accident death rate among bituminous miners was 2.12 per million tons mined, compared with 2.09 in July, 1941.

The anthracite fatality rate from accidents in July last was 3.93, based on an output of 5,341,000 tons, against 3.20 in the seventh month of 1941.

For the two industries combined, the accident fatality rate in July last was 2.30, compared with 2.20 in the corresponding month of last year.

Fatalities during July last, by causes and states, as well as comparable rates for the first seven months of 1941 and 1942, are as follows:

DEATHS AND FATALITY RATES AT UNITED STATES COAL MINES, BY CAUSES OF ACCIDENTS*

January–July, 1941 and 1942

	Bituminous				Anthracite				Total			
	Number Killed		Killed per Million Tons		Number Killed		Killed per Million Tons		Number Killed		Killed per Million Tons	
Cause	1941	1942	1941	1942	1941	1942	1941	1942	1941	1942	1941	1942
Underground;												
Falls of roof and coal	304	327	1.131	0.982	63	88	2.057	2.525	367	415	1.226	1.128
Haulage	105	123	391	.369	16	20	.523	.574	121	143	.404	.389
Gas or dust explosions:												
Local	14	5	.052	.015	5	5	.163	.143	19	10	.063	.027
Major	43	121	.160	.363	.....	.....	.....	.....	43	121	.144	.329
Explosives	12	12	.045	.036	8	8	.261	.230	20	20	.067	.054
Electricity	13	28	.048	.084	2	3	.065	086	15	31	.050	.084
Machinery	18	22	.067	.066	.....	1	.....	.029	18	23	.060	.063
Shaft	2	3	.007	.009	2	2	.065	.057	4	5	.013	.013
Miscellaneous	6	18	.022	.054	7	8	.229	.230	13	26	.043	.071
Stripping or opencut	14	13	.052	.039	2	1	.065	.029	16	14	.053	.038
Surface	22	27	.082	.081	8	7	.261	.201	30	34	.100	.092
Grand total	553	699	2.057	2.098	113	143	3.689	4.104	666	842	2.223	2.288

*All figures subject to revision.

UNITED STATES COAL-MINE FATALITIES IN JULY, 1942, BY CAUSES AND STATES

	Underground											
State	Falls of Roof	Falls of Face	Haulage	Gas or Dust Explosions	Explosives	Electricity	Machinery	Other Causes	Total Underground	Open-Cut	Surface	Grand Total
Alabama	2	..	1	..	..	..	..	..	3	..	..	3
Arkansas	..	..	..	..	..	1	..	..	1	..	..	1
Colorado	..	..	1	..	..	..	..	..	1	..	..	1
Illinois	2	..	1	..	..	1	..	..	4	..	..	4
Indiana	..	..	..	..	..	..	..	1	1	..	..	1
Kansas	..	..	..	..	..	..	..	..	..	1	..	1
Kentucky	8	..	1	..	..	4	..	..	13	..	..	13
New Mexico	1	..	..	..	..	..	..	..	1	..	..	1
Ohio	2	..	3	..	..	1	..	..	6	..	2	8
Oklahoma	1	..	..	..	..	..	..	..	1	..	..	1
Pennsylvania (bituminous)	8	..	4	..	..	..	..	..	12	1	1	14
Tennessee	1	..	..	..	..	..	..	..	1	..	..	1
Utah	..	..	2	..	..	..	..	..	2	..	..	2
Virginia	1	..	..	..	..	..	..	..	1	..	..	1
Washington	..	..	..	..	..	..	..	1	1	..	..	1
West Virginia	13	..	3	20	1	2	3	..	42	..	4	46
Wyoming	1	..	1	..	..	..	..	..	2	..	..	2
Total bituminous	40	..	17	20	1	9	3	2	92	2	7	101
Pennsylvania (anthracite)	9	2	2	1	3	..	1	1	19	..	2	21
Grand total	49	2	19	21	4	9	4	3	111	2	9	122

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Anthracite Teams Take Majority of Awards In Pennsylvania Safety Contest

ANTHRACITE first-aid teams took most of the honors in the Third Annual Pennsylvania Safety Day and First-Aid Contest held at Artillery Park, Kingston, Pa., Sept. 19. The event was sponsored by Richard Maize, Secretary, and the Anthracite division of the Pennsylvania Department of Mines in cooperation with the United Mine Workers of America, anthracite operators and the U. S. Bureau of Mines.

Approximately 2,000 contestants, officials and spectators, many coming from the more distant bituminous fields, attended the event, held during the preceding ten years in conjunction with the Cambria County Fair at Ebensburg, Pa. Officials included J. J. Walsh and W. Garfield Thomas, deputy secretaries of mines. The general committee, headed by Andrew Wilson, Pennsylvania Coal Co. (chairman), included James Munley, state mine inspector (treasurer), and Osborne Morgan, Lehigh Valley Coal Co. (secretary).

While 54 teams competed for the seven winning places in the State-wide contest, participants from the anthracite district strove for the additional John Ira Thomas trophy, donated by the anthracite operators for the best anthracite team, and awarded by Cadwallader Evans, Jr., vice-president and general manager, Hudson Coal Co. General Reinsurance Corp.'s R. D. Currie served as chief judge.

Both the gold cup for first place in the State contest, donated by the Mine Safety Appliances Co., and the John Ira Thomas Trophy were awarded to Maple Hill Colliery team, Philadelphia & Reading Coal & Iron Co., with a score of 99.80. This team, headed by Capt. James Gayuskie, received an additional award of $25 per man, and was composed of Victor G. Moss, Jerome Hyland, Fred Stutz, William Baker, Robert Maul and Anthony Yanowsky.

Second place (anthracite division) with an M-S-A silver plaque and $20 per man went to the Locust Coal Co.'s team, composed of Edward Koch, captain, and Joseph Hartzel, Michael Holetsky, Albert Kurswidas, John Koch, Pierce Richards and James Barrett.

Second place (bituminous division), also bearing awards of an M-S-A silver plaque and $20 cash per man, went to the Consolidation Coal Co.'s Mine No. 120 team, Acosta. This team was made up of Kenneth Roberts (captain), Carl Smith, George Smith, Milton Smith, Nelson Roberts, Christopher Weimer and Obie Ryman.

Third prize ($15 per member) went to Knickerbocker colliery, Philadelphia & Reading Coal & Iron Co.; fourth ($10 per member) to the Lehigh Navigation Coal Co., Tamaqua colliery; fifth and sixth, ($5 per man), to Dorrance colliery, Lehigh Valley Coal Co., and Team No. 1, Colonial Colliery Corp., respectively. A ladies' team from the Department of Mines was on the field and, although not competing for awards, performed the contest course of problems, and received individual awards, presented by Mr. Maize. A brief eulogy on John Ira Thomas, who gave his name to the anthracite award, was delivered by Mr. Evans in presenting the award to the Maple Hill colliery.

•

Miner Loses Silicosis Action

A jury in Harlan (Ky.) Circuit Court returned a verdict Sept. 14 against C. J. Weldon, miner, who sought $25,000 from the United States Coal & Coke Co., charging that he contracted silicosis after breathing sandstone in the company's Lynch mine.

•

New Preparation Facilities

Tunnel Ridge Coal Co., Silver Brook, Pa.—Contract closed with Wilmot Engineering Co. for one 7-ft. Wilmot Hydrotator to prepare 40 t.p.h. of clean rice coal; and one to prepare 40 t.p.h. of clean barley coal.

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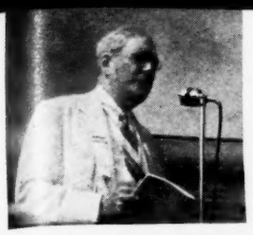


Cadwallader Evans Jr. presents Ira J. Thomas anthracite-team trophy.

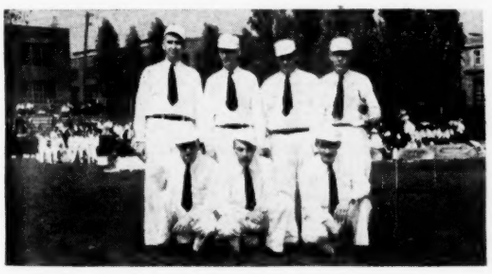
U. S., State and M-S-A: W. Garfield Thomas, George Deike, Richard Maize, J. J. Walsh and J. J. Forbes.

State-wide and anthracite winners, Maple Hill colliery: James Gayuskie, Victor G. Moss, Jeron Hyland, Fred Stutz, William Baker, Robert Maul and Anthony Yanowski.

PENNSYLVANIA SAFETY MEET

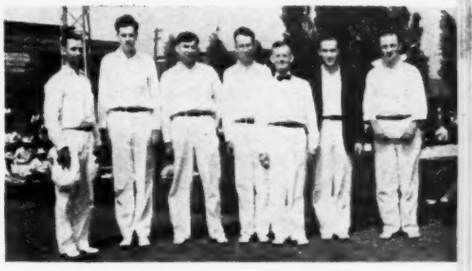
Second place, bituminous, Acosta No. 120, Consolidation Coal Co.

Second place, anthracite division, Locust Coal Co. team.



Fourth place, Tamaqua colliery, L. N. C. Co.

Fifth place, Dorrance colliery, Lehigh Valley.



Sixth, Team No. 1, Colonial Colliery Corp.

Girls' team, Pennsylvania Department of Mines.

W. Garfield Thomas poses with George Deike.

Pennsylvania anthracite inspectors.

Pennsylvania bituminous inspectors.

First-Aid Meets Attract Numerous Competitors

With 16 teams entered—two women's teams and two colored—a well-attended first-aid meet was held Aug. 29 at Williamson, W. Va. The meet was sponsored by the Pond Creek-Tug River Mining Institute, with the cooperation of the U. S. Bureau of Mines, the Kentucky Department of Mines and Minerals, and the United Mine Workers of America.

First prize went to Mine No. 7, Eastern Coal Corp., McVeigh, Ky.; second prize to Hardy mine, Eastern Coal Corp.; third to Pond Creek mine, Leckie Collieries Co., Aflex, Ky. First prize for women's teams was captured by the Octavia Coal Mining Corp., McAndrews, Ky., organized only six weeks previous. First award for colored teams went to Pond Creek mine, Leckie Collieries Co. E. S. Hamilton, president of the institute, awarded the prizes, assisted by G. M. Patterson, Chief, Kentucky Department of Mines and Minerals.

Forty-eight teams competed in the Central Pennsylvania Safety Association meet, held Aug. 1 at Barnesboro. The order of finish of the first five teams, which were to compete at the State met at Kingston, Pa.; was: (1) Barnes & Tucker No. 15 mine; (2) Rockhill Coal Co. Mine No. 1; (3) Koppers Coal Co. Sonman Shaft; (4) Rockhill Coal Co. Mine No. 9; (5) Sterling Coal Co.

Leaders in the first-aid contests featuring the third annual industrial safety meet, held Aug. 1 at Denver, Colo., were: men's division—(1) Clayton Coal Co.; (2) Kebler No. 2 mine, Colorado Fuel & Iron Corp. The Governor's Cup, presented by Governor Ralph L. Carr, became the permanent possession of the Clayton Coal Co., having been won four consecutive years by this group.

The Harvey Coal Corp.'s team won the mine-rescue contest held Sept. 19 at the 16th annual field day and safety meet in Lothan, Ky., for mines of the Hazard coal field. Second was the Blue Diamond Coal Co. team; third, Campbell Creel Coal Co. team. Results of the men's first-aid event, which drew 14 teams, were: first, Columbus Mining Co.; second, Blue Diamond Coal Co.; third, Algoma Block Coal Co. Boys' first-aid team results were: first, Blue Diamond Coal Co.; second, Hardy-Burlingham Mining Co.; third, Harvey Coal Corp. The Blue Diamond girls' team defeated the Hardy-Burlingham girls.

•

Oil Froth at Lansford Cleans Silt Coal for Boilers

Froth flotation will be used by the Lehigh Navigation Coal Co. to clean 700 tons of 35- to 200-mesh anthracite daily. The material to be thus processed will be reclaimed from the waste water of the breaker at Tamaqua, Pa. Tentative plans also have been prepared for similar recovery of coal from the waste of the other company collieries. An eight-cell Denver Equipment Co. flotation unit has been operating in a pilot plant establishing the data from which the new and larger installation will be designed. This plant will not only provide a marketable fuel but will relieve Panther Creek, the Little Schuylkill River, and points beyond of some of the impurities these streams are now receiving.

The principal user of this fine coal will be the Pennsylvania Power & Light Co. at its Hauto power plant, which recently has been enlarged 50 percent by the addition of generators and boilers, the latter to be fired with pulverized coal. This plant alone will require about 1,000 tons of coal daily, or nearly a carload per hour. The pilot plant adjoins the Lansford breaker on the West, and has been operated under the general supervision of Charles D. Rubert, superintendent of preparation, and under the immediate charge of W. Julian Parton. Fuel oil is used as the collector and pine oil as frother. Experiments have been made, however, in the use of other reagents to replace those mentioned in case the exigencies of the war make them difficult to obtain. At the pilot plant, the coal is dried by a Bird centrifugal filter.

When the froth-flotation plant is in production, an increasing demand for fine sizes of coal may justify the treatment of material in the many silt banks that have accumulated in the Panther Creek valley over a long period. It is estimated that between 2,000,000 and 3,000,000 tons of this waste is piled up in banks, the largest of which is at Coaldale. It may be possible to recover 50 to 60 percent of this material in the form of marketable coal.

•

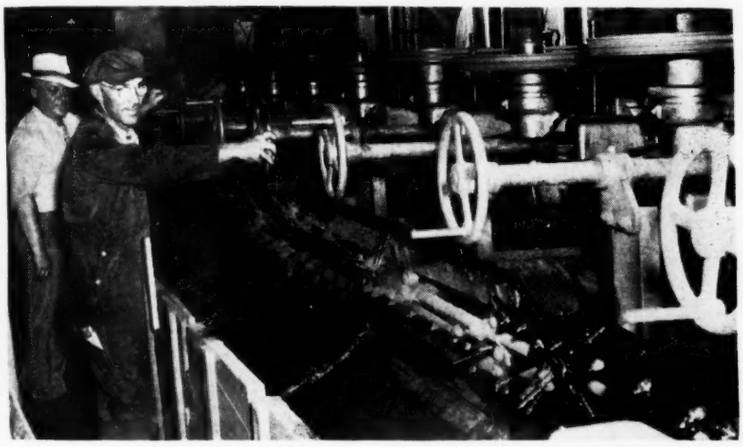
Many Possibilities Offered By Coal Research

(*Continued from page 64*)

will be in the future. Nylon and phenol plastics are dependent on benzene.

"Production of benzene, now principally from coke ovens, depends upon the activity of the steel industry. If it is to serve as the basic material of a large industry, other sources of production must be provided. It has been made in the laboratory by hydrogenation of coal and by oxidation treatment of coal. It has been made commercially from petroleum for some time, according to reports of Anglo-Iranian Oil Co., and it is now reported to be made from petroleum in this country. Research should now be under way to produce benzene directly from coal to share in this market.

"*Dustproofing of Coal*—Last year, ac-



Where Lehigh Navigation Coal Co. recovers the clean coal from breaker waste water by froth flotation

cording to statistics, the coal industry used, for dust treating, 60,000,000 gal. of oil. This industry's oil bill was about $5,000,000. Why not make a dustproofing agent from our own coal? Tars have been used but, as such, were not completely satisfactory nor generally available in mining districts. Oil products were not completely satisfactory in the beginning, either, but the oil companies developed a coal-spray oil specifically for the job. Suitable coal hydrogenation and oxidation products can be made in the laboratory now and might be made commercially from tipple dust, washery slurry and reject coal by further research. Such an accomplishment would be in effect a market for these waste products.

"*Hydrogenation* — The hydrogenation or liquefaction of coal is not a commercial process because of low-cost petroleum in this country. Partial hydrogenation, however, yields the light oils, benzene, toluene, etc., and also much larger quantities of phenolic compounds for plastics than can be obtained from the coke oven. Such a process might be operated more cheaply than complete hydrogenation and yield marketable products at competitive prices. The U. S. Bureau of Mines is now expanding its hydrogenation program.

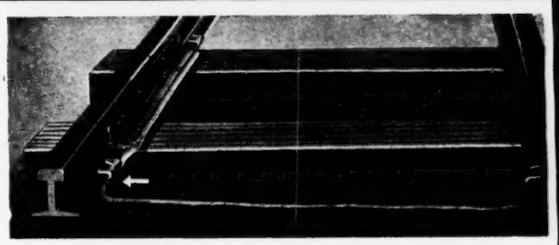
"Low-Ash Carbon—Aluminum and magnesium production has multiplied with the war. Experts predict that the postwar demand for these light metals will be much greater than at any previous time. Carbon electrodes are used in the process of refining and most of them come from petroleum and pitch coke because of the low ash content. Low-ash carbon has been made in the laboratory from coal by dissolving it in tetralin, derived from coke-oven products, filtering the ash and coal portion resistant to attack and boiling off the solvent. In the laboratory, the Pittsburgh-seam coal has been so converted, yielding 70 percent of original weight with an ash content of 0.0 to 0.5 percent.

"For aluminum alone, our present annual rate of production is about 1,000,000,000 lb. On the conservative basis of 0.5 lb. of carbon used per pound of aluminum, the demand for electrode carbon is 250,000 tons per year. Here again, grades and sizes not readily marketed might be processed and sold at a premium.

"Such low-ash carbon has been used in Europe as a fuel for the coal-dust engine, with satisfactory results reported. This might be the coal industry's answer in the future to the diesel engine. Further research will tell.

"The projects cited are only a few of the many that need further research. Many are still in the laboratory stage and time and money are required to prove their commercial possibilities. Much of the basic work has been done, however, and your research organizations are proceeding as rapidly as funds become available. They are certainly deserving of your encouragement and financial support. Join this movement and help research to help you. Let's keep looking ahead!"

Save 50 PER CENT ON THE COST OF Cross-Bonding AND INCREASE EFFICIENCY

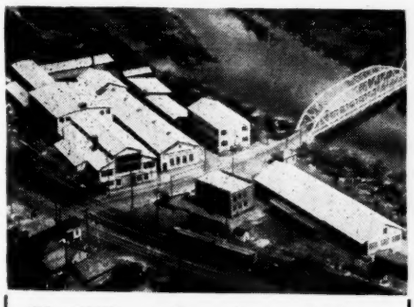


BY USING THE MESCO COMBINATION JOINT AND CROSS-BOND TYPE M8x-F

• The Mosebach Quality Rail Bond Type M8x-F is a combination of the conventional Joint Bond and Cross Bond, built as a single unit. It has 3 terminals instead of 4, as would be the case if separate Joint and Cross Bonds were used. Thus it requires fewer mine welds, less welding rod, and less time to install, resulting in a saving of both time and money.

Write for complete information

MOSEBACH
ELECTRIC & SUPPLY COMPANY
1115 Arlington Avenue Pittsburgh, Pa.



The Wilmot Foundry and Shops Are PREPARED *to Help You*

Maintain Maximum Wartime Efficiency of Anthracite Coal Cleaning Equipment

★

WILMOT ENGINEERING COMPANY
Offices: Hazelton, Pa. : : *Works:* White Haven, Pa.

WILMOT
A GREAT NAME IN THE COAL INDUSTRY
HYDROTATOR COAL *Preparation* UNITS

QUALITY MARLO PACKING

METALLIC & SEMI-METALLIC
PACKING
for
MINE PUMPS
"The Packing that gets the Repeat Orders"

For deep mine pumps. Resists acid mine waters. Keeps grit out of stuffing box. Three types.

• MARLO ALL PURPOSE METALLIC PACKING
Best ever devised. Will not freeze at 70° below. Soft, pliant, like fibrous types, yet easier to handle. Won't cut, score or corrode moving parts.

• "TWIN-TWIST" SEMI-METALLIC PACKING
Metal strands twisted with asbestos. Anti-frictional. Durable. Economical. Remarkable compressability. Never hardens. For temperature up to 550° F.

• "RED WATER" SEMI-METALLIC PACKING
Most modern development for all hydraulic applications. A solid-packing vegetable fibre combined with metal strands. Retains form under any conditions.

Let us serve you!

THE MARLO COMPANY
38 HOWARD ST.
NEW YORK, N. Y., U. S. A.

A MAINTENANCE MESSAGE TO USERS OF SUPER SERVICE*

It has been said, and repeated, in these pages that the hydraulically moulded jacket of **SUPER SERVICE** Portable Mining Cable is tougher than any abuse to which ordinary usage may subject it.

But Today **EVERY SLIGHTEST ABUSE SHOULD BE AVOIDED**

Treasure it, take care of it—just as thoughtfully as if it were tender, instead of the **TOUGHEST** cable construction for portable mine use.

*Trade-mark

IT WON'T KINK
... but DON'T *try it.*

IT'S WATERPROOF
... but DON'T *let it lay in puddles.*

IT RESISTS CRUSHING
... but DON'T *expose it to hazards.*

IT RESISTS ABRASION
... but DON'T *drag it; reel it up for moving.*

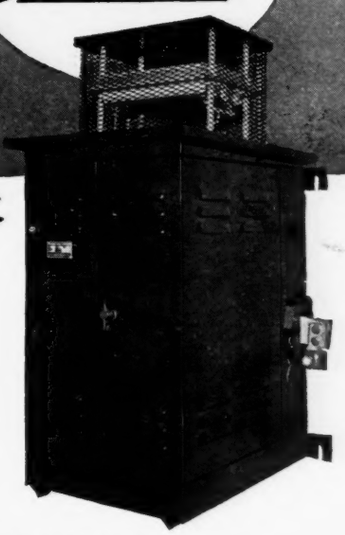
GENERAL CABLE

BARE and INSULATED WIRES and CABLES for EVERY ELECTRICAL PURPOSE

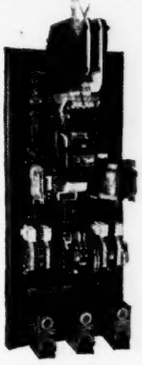
General Cable Corporation Sales Offices: ATLANTA • BOSTON • BUFFALO • CHICAGO • CINCINNATI • CLEVELAND • DALLAS • DETROIT • HOUSTON KANSAS CITY (MO.) • LOS ANGELES • NEW YORK • PHILADELPHIA • PITTSBURGH • ROME (N.Y.) • ST. LOUIS • SAN FRANCISCO • SEATTLE • WASHINGTON (D.C.)

MAINTENANCE REPAIR PARTS for Automatic Reclosing CIRCUIT BREAKERS

Better Faster



Type KSC Sectionalizing Circuit Breaker ▶



◀ Type KSA Substation Circuit Breaker

TO GAIN the most in service from your installation of I-T-E Automatic Reclosing Circuit Breakers, whether of the substation or sectionalizing type, there are just a few things to do. Each is as important as it is simple.

Here is the list. Use it as the basis of your maintenance program.

1. Inspect all current carrying parts regularly and replace worn arcing tips promptly.
2. Tighten binding post nuts on the rear of the panel periodically.
3. Keep a spare set of coils, resistors and contacts at hand.
4. Give complete name plate data and be sure to include the serial number when ordering parts.
5. Anticipate repair parts for old apparatus by 60–90 days to avoid disappointment.
6. Have readily available complete Instruction and Repair Part Booklets.

Representatives in Principal Mining Areas

I-T-E

AIR SWITCHGEAR

IMMERSED IN AIR — ENCASED IN STEEL

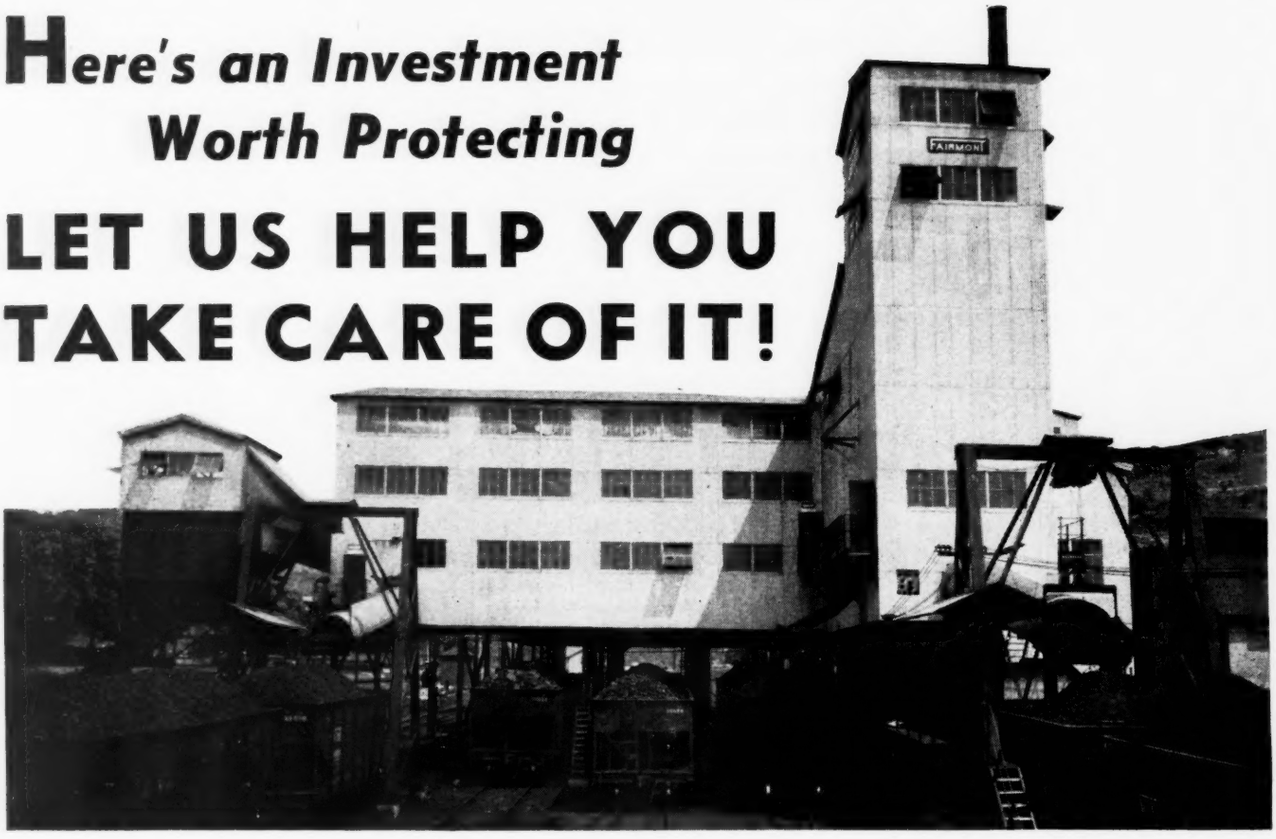
ARMY E NAVY

I-T-E

CIRCUIT BREAKER CO., PHILADELPHIA, PA.

Here's an Investment Worth Protecting

LET US HELP YOU TAKE CARE OF IT!



TRADE MARK REGISTERED
FAIRMONT

Preparation Service includes a system to meet your specific cleaning requirements — Wet or Dry.

The Chance Sand Flotation System offers at high capacity, thoroughly dependable wet process of coal cleaning. A system that has proved highly successful throughout the coal industry where highest efficiency and a better quality of coal could be obtained with the wet process.

The American Pneumatic Separator provides a dry coal cleaning system of exceptional efficiency. It is now being used very successfully by operators whose plants and coal production are more adaptable to a dry method of cleaning.

Consult Fairmont Engineers on your coal preparation.

● Your preparation plant represents a major investment. Between us we can give it the care it deserves —properly maintain the equipment in it—replace worn parts before they fail and cause serious production delays.

Fairmont offers complete servicing of the plants it has erected and of equipment it has furnished operators. Don't neglect your supervision and maintenance now when the demands of War require every ton of available coal—properly prepared coal to meet vital production needs.

Although we are actively engaged in the production of vital materials of war to help speed this war to a successful conclusion—we are prepared to service and maintain existing Fairmont installations.

Consult us on your service requirements.

TRADE MARK REGISTERED
FAIRMONT MACHINERY COMPANY
FAIRMONT, W. VA.

Eye Accidents are Serious in Times of Peace... DISASTROUS in TIMES OF WAR!

...all your Mine Workers Need *AO GOGGLES*

In normal times, unguarded eyes are constant threats to profits.

Today, an eye accident to a miner will not only disrupt production schedules and raise costs, but it may also rob you of the services of an *irreplaceable* worker... a man it took a long time to train.

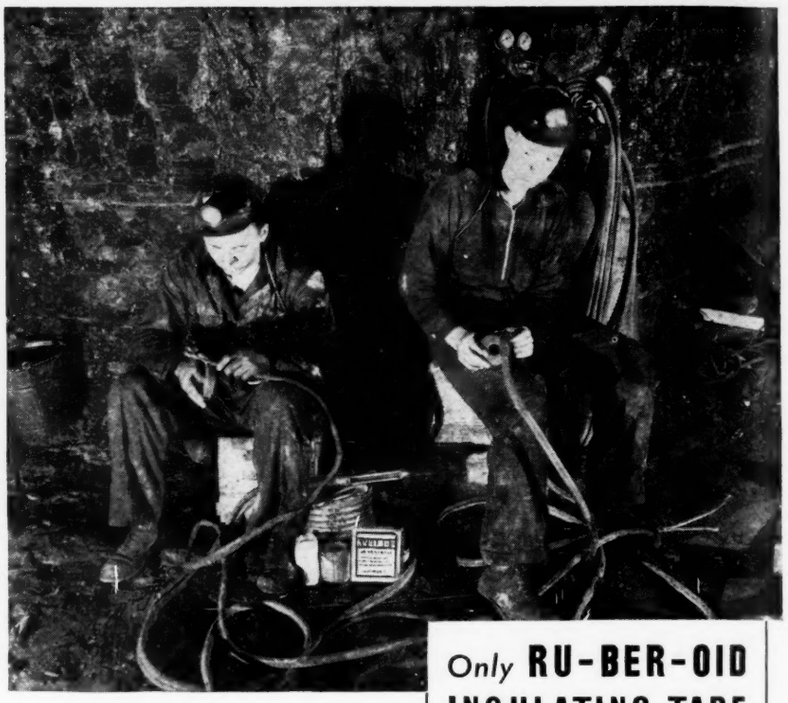
Don't take a *single* chance of letting eye accidents strike your property! American Optical Company offers the correct protection for every type of eye-hazardous job. AO goggles are strong, light, comfortable, easily fitted. Your Mine Safety Appliances Company representative will gladly show you how they can protect eyes on your property . . . call *him* today.

American Optical

COMPANY

SOUTHBRIDGE, MASSACHUSETTS

It's tough to get cable replacements but..
PRODUCTION SPEEDS ON WITH THIS 7-FEATURE INSULATING TAPE



National Defense demands make new cable more and more difficult to get . . .

. . . but your company can keep production moving—reduce power losses—save time and money—by using this *dependable* RU-BER-OID Insulating Tape for cable splices. Only Ruberoid gives you all the seven features listed herewith.

Make sure you get *all* these features! For more than 50 years RU-BER-OID Insulating Tape has been the choice of cost-minded operators for maintenance work. It resists acids, alkali and moisture—lasts in spite of abrasion by sharp coal. Grimy or oily hands fail to loosen its grip. Tough, durable, both sides adhesive, extra thick—this insulating tape has *proved* itself a time-saver and a money-saver.

Specify RU-BER-OID Insulating Tape by name. Your supply house has it. Let this heavy-duty tape help you speed production and reduce maintenance costs.

Only RU-BER-OID INSULATING TAPE *has all these 7 features*

1. Double grip . . . both sides adhesive
2. Great tensile strength . . . tough
3. Won't tear, ravel or pucker
4. Resists abrasion
5. Acid- and alkali-proof
6. Extra thick . . . one layer insulates
7. Exceeds A.S.T.M. specifications by 300% in adhesiveness, 26% in tensile strength, 290% in dielectric strength

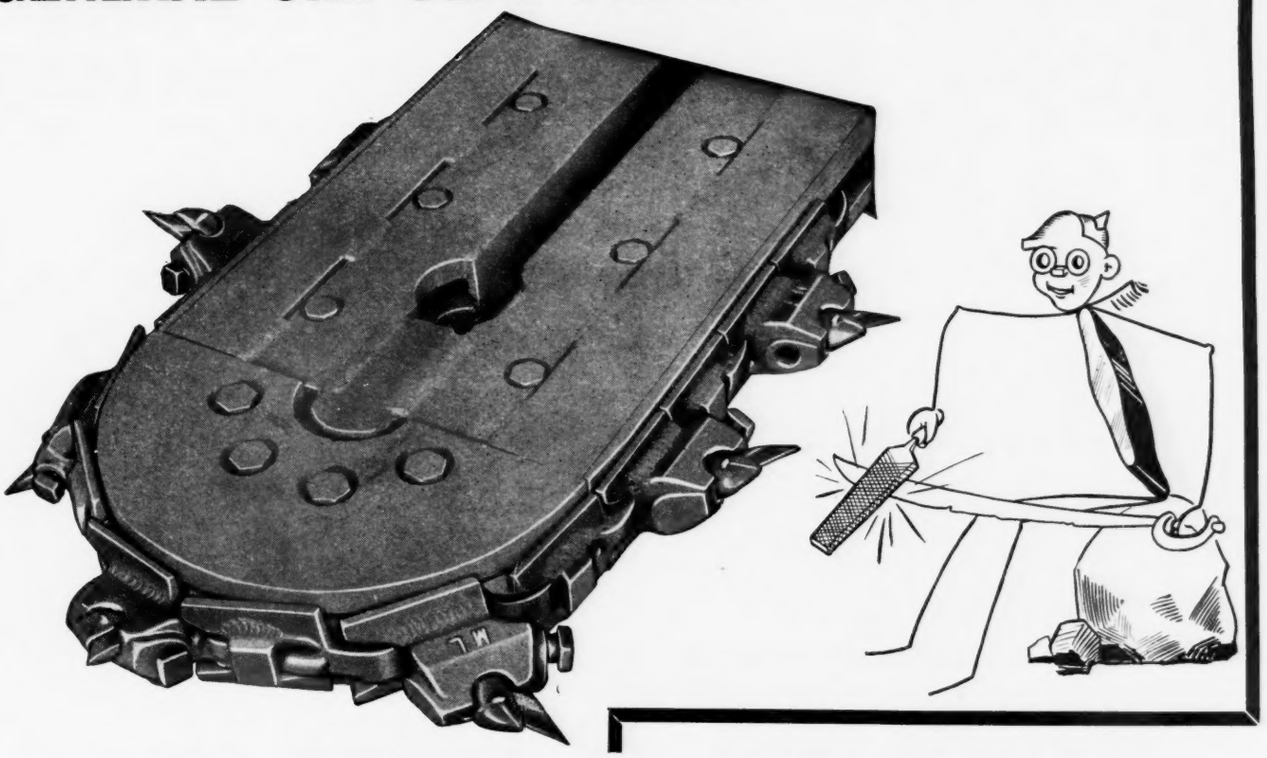
RU-BER-OID
INSULATING TAPE

OTHER RU-BER-OID PRODUCTS FOR COLLIERIES

ROLL ROOFING
ASBESTOS-CEMENT SHINGLES
ASPHALT SHINGLES
INSULATING PAINTS
BUILT-UP ROOFS
ASBESTOS INSULATIONS
ASBESTOS AND MAGNESIA PIPE COVERINGS
ROOF COATINGS
PATCHING PLASTIC
CORRUGATED ASBESTOS-CEMENT ROOFING AND SIDING

THE RUBEROID CO., EXECUTIVE OFFICES: 500 FIFTH AVENUE, NEW YORK

GENERAL JIM SLIM SAYS:



"AN OUNCE OF PREVENTION IS WORTH A POUND OF CURE"

WE'LL DO MORE WORK LONGER, IF WE'RE TREATED RIGHT NOW . . . THE BOWDIL CUTTER BAR, CHAIN AND ME

• Today it is imperative that every piece of available equipment be in "tip-top" working condition—and kept that way. Never before in the history of this country have mine operators been called upon to deliver so much in so short a time. The only way this can be accomplished is by a regular maintenance program which will include frequent inspection and a constant schedule of repairs.

As a suggestion for helping you to keep your cutter bar working on round-the-clock schedules, we have listed, at the right, several suggestions for maintaining your Cutter Bar, Chain, and Me. Full particulars in our catalog. Write for one.

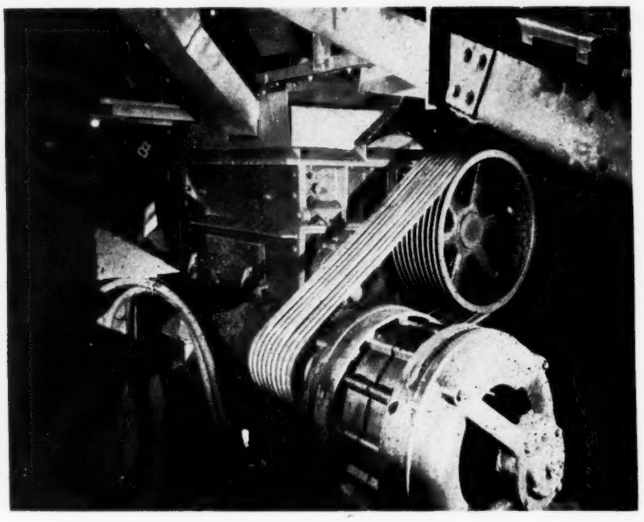
1. SAVE STEEL! !—Distribute cutter bits from supply house and require all bits to be returned for inspection before scrapping. Bits turned in with only one point unused or not fully worn out should be sent back for further use.
2. Oil cutter chain at least after several places have been cut, and always upon completion of shift.
3. Tighten bits properly and reduce bit loss.
4. Keep cutter chain adjusted ¾" slack under frame in most cases.
5. Be sure cutter head is tight. When worn or too open, report to maintenance authority.
6. Don't operate chain unnecessarily when not actually cutting coal. This practice is a safety hazard and wastes steel by dulling bits.
7. Use care in setting jacks so bits will not strike them.
8. Bowdil Cutter Bars and Bits cut a thinner kerf, less fines; save power and reduce wear and tear on machine motors and gears.
9. Keep us advised of your requirements well ahead of actual needs.

The BOWDIL Company
Canton COAL CUTTING EQUIPMENT Ohio

CRUSH LARGE TONNAGES DAY AFTER DAY

AMERICAN "AC" Type ROLLING RING CRUSHER

KEEP AHEAD IN SUPPLY OF UNIFORM STOKER COAL SIZES



DOUBLE ADJUSTABILITY

The adjustable grinding plate and the adjustable drop bottom cage permits varying the clearance between the rotor. By adjusting these members the operator can obtain any size of product within the crusher range.

Externally adjusted

All adjustments are made externally and while the crusher is in operation.

REVERSIBLE MANGANES STEEL SHREDDER RINGS

These rings (a patented feature) split the coal and prevent clogging. Revolving at a slow speed a minimum of fines are made. The rings are reversible and have 20 cutting edges or teeth. No shear pins or other safety devices are required as the rings are free to swing back out of position.

METAL TRAP

There is a build-in metal trap for removing tramp iron from the Crushing Chamber.

UNIFORMITY OF PRODUCT SIZE

In addition to getting greater range of reduction, the AMERICAN Rolling Ring Crusher gives you uniformity of sizes.

GRINDING PARTS

The crushing parts are: breaker plate, grinding plate, grate bars, and rings. All made of manganes steel. It applies centrifugal force at right angles to a horizontal shaft. The rings strike, roll, and grind. They are thrown back when they encounter non-crushable material, protecting the crusher from damage by foreign materials. This flexibility or "give" makes the crusher self-acting against tramp material.

TOTAL COST OF LESS THAN ONE CENT PER TON

Including power, handling, maintenance, and interest on investment is an every day achievement for AMERICAN Rolling Ring Crushers. It is not unusual for users to crush several hundred thousand tons with one set of crushing parts. This means that your maintenance costs are **VERY LOW.**

Built in many sizes, each unit is arranged to meet the particular requirements of each application.

These crushers are very compact, easy to operate, and are quickly accessible.

With industrial users and war plants stock-piling coal to storage capacity limits, it is suggested that you plan for early as possible installation of this unit so that you will be ideally equipped for efficiently reducing coal to stoker sizes.

AMERICAN PULVERIZER COMPANY 1119 MACKLIND AVENUE ST. LOUIS, MISSOURI

ORIGINATORS AND MANUFACTURERS OF RING CRUSHERS AND PULVERIZERS

Du Pont Electric Blasting Cap—metal foil shunt provides positive short circuit of leg wires, yet is quickly removed by pulling wires apart

Du Pont Electric Blasting Caps for coal mining are so designed that the interval of time between the operation of the blasting machine and the instant of detonation is *longer* than that provided by caps for other types of blasting.

This exclusive du Pont safety feature—referred to as a "long cap lag"—is made possible by the use of a special ignition mixture. This mixture burns at a sufficiently slow rate so that the cap cannot detonate until after the current from the blasting machine has fallen to an extremely low value—so low, in fact, that it cannot arc between the leg wires. Because of this feature the use of Du Pont Electric Blasting Caps entirely eliminates the hazard of sparks arcing across the leg wires and causing the ignition of coal gas and dust released by the blast.

E. I. du Pont de Nemours & Co. (Inc.), Explosives Department, Wilmington, Del.

DU PONT
REG. U. S. PAT. OFF.

EXPLOSIVES

BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

DRILLING

ROAD CONSTRUCTION AND MAINTENANCE

PAINT SPRAYING

GUNITING

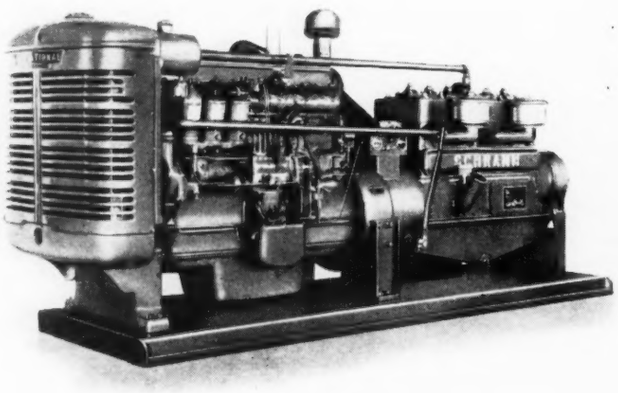
TIMBER SAWING

AUXILIARY VENTILATION

A Construction and Maintenance Crew on Wheels

Putting a SCHRAMM Portable Compressor in the hands of even semi-skilled laborers is like providing infantrymen with jeeps—*They go places and get things done!* Whether you're opening up a new property or stepping up the output of an old one, air power at the touch of a button enables you to do the impossible in a hurry.

From Alaska to the Deep South mining engineers have found SCHRAMM means hard-hitting dependable, economical power—regardless of temperature or altitude. For *all* Schramm Compressors have straight-lined cylinders, water-jacketed for correct lubrication at all temperatures . . . Mechanical intake valve . . . Operate at most economical engine speed, using less fuel for air delivered . . . No auxiliaries to buy—shipped ready for action . . . Distributors and Service Stations convenient to coal mining centers both here and abroad. Write today for new catalog 42SP. Has complete illustrated data and prices.



GASOLINE . . . DIESEL . . . ELECTRIC in portable or stationary models ranging from 20 to 600 cu.ft. Illustrated above is self-aligned, direct connected diesel engine driven compressor of 315 cu.ft. actual air delivery. This is a complete unit furnished as shown on deck type base.

SCHRAMM
INCORPORATED

THE COMPRESSOR PEOPLE

WEST CHESTER, PENNA.

the swing is to

WHEAT

The Engineered Cap Lamp

12 *Reasons why*

1 Two bulbs (one for emergencies) — miner is never in the dark.

2 Center mounted, Krypton-filled bulb, gives 20% more light — no dark "shadow spot" in beam.

3 Choice of 3 reflectors gives narrow concentrated beam, a medium beam, or a widespread beam of light — suits all working conditions.

4 Headpiece weighs less than 6 ounces, Lamp Cord 6 ounces, Battery 62 ounces — Total weight of Lamp complete 74 ounces.

5 Headpiece molded of strong bakelite; sealed, moisture-proof and dust-proof.

6 Rubber battery case — non-conductor of electricity — a valuable safety feature.

7 Battery solution (free) limited to one ounce total both cells.

8 Lead-acid type battery maintains high voltage throughout shift (80+% efficiency) — year after year.

9 Battery charged through headpiece and cord of cap lamp — a daily test of all connections.

10 Designed for self-service charging system for lowest lamp-house operating cost.

11 To charge, headpiece is simply slipped on to key in charging rack, and turned to make contact. Nothing to take apart — unit-sealed construction.

12 A payment plan (purchase or rental) to meet the requirements of companies — large and small.

Note — More New Wheat Cap Lamps were installed in the U.S.A. during 1940-1941 than in any previous 2-year period

"Wheat Mine Lamps are the only Mine Lamps 'powered' by Exide Ironclad Battery Plates made by the ELECTRIC STORAGE BATTERY CO., The World's Largest Manufacturers of Storage Batteries for every purpose."

Write today—

WHEAT LAMP SALES, INC.

1501 Kanawha Valley Bldg., Charleston, W. Va.

SPECIALISTS IN MINE LIGHTING FOR 25 YEARS

KOEHLER MFG. CO.

Marlboro · · · Mass.

RUGGED · DEPENDABLE SENSITIVE

7 ways to make your VENTUBE* system give you longer service

IF YOU are one of the hundreds of Du Pont VENTUBE system users today, you know its value in promoting continuous operation, increased efficiency and maximum production by quickly clearing the working face. Today—and for the duration-your system whether old or new has a mighty important wartime job to do. VENTUBE systems are well made. They're strong and durable and with proper care they will stand up for a long time. Stretch out that service . . . make your system serve you even longer by following these 7 simple suggestions:

1. Inspect VENTUBE systems in use at regular intervals.

2. Always be certain VENTUBE is securely anchored on messenger wires and that all stagger hooks are used.

3. Avoid sharp vertical or horizontal bends or kinks. These cut air discharge and may injure the tubing.

4. Repair leaks, tears, rips and burns promptly...using the specially prepared Du Pont VENTUBE Cement and patching cloth for this purpose.

5. Be certain blowers are regularly lubricated and that tube couplings and connections are properly adjusted.

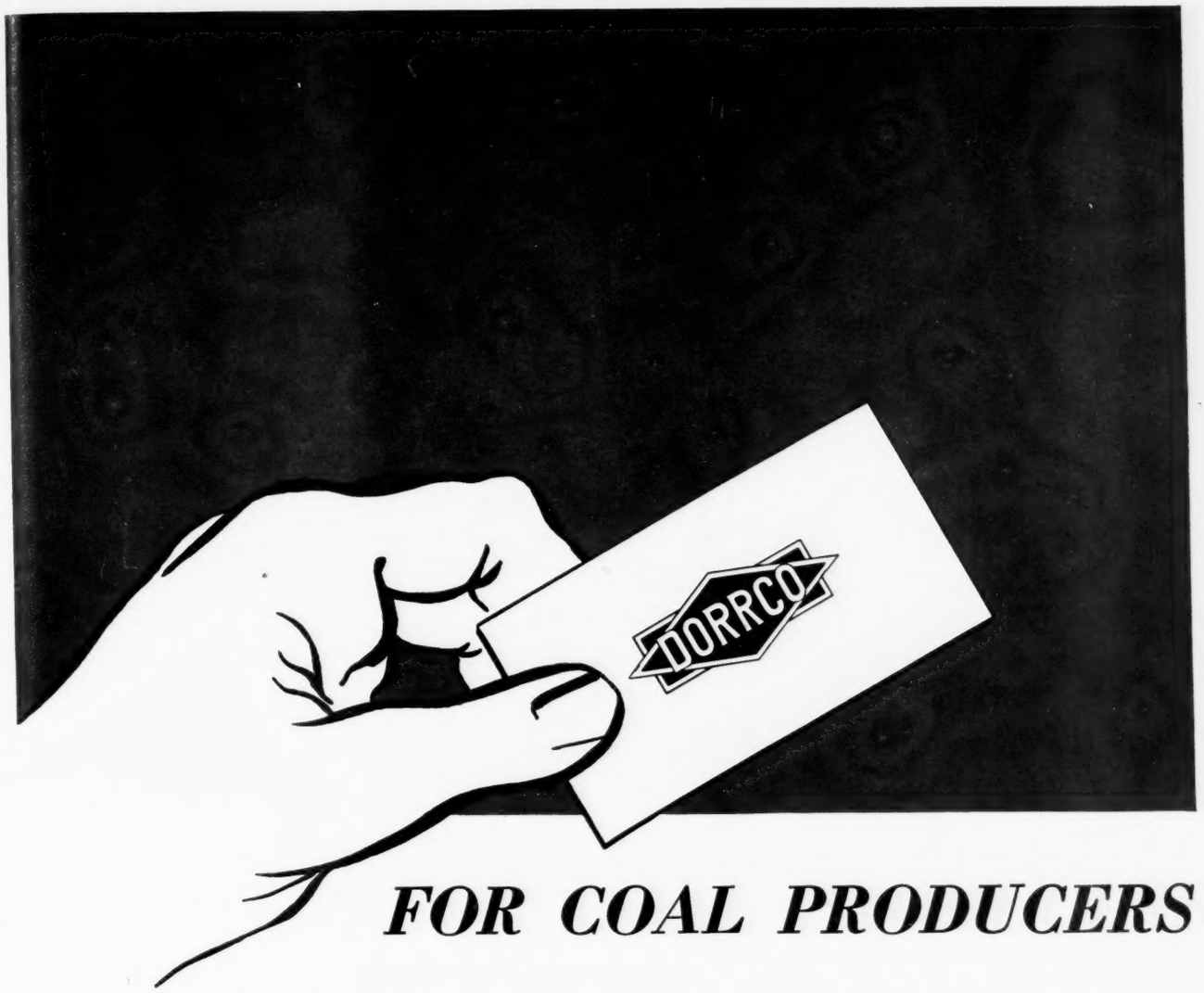
6. VENTUBE is strong and resists a lot of abuse. But be reasonable. Avoid dragging VENTUBE over rocks, gob, rubbish or loose coal, whenever possible.

7. Safeguard VENTUBE when not in use. THIS IS IMPORTANT! Observe these rules: 1. Clean both inside and outside of tube with clear water. 2. Hang up to dry thoroughly. 3. Fold or roll tubing neatly: avoid wrinkling or creasing. 4. Store VENTUBE in a cool, dry place away from heat or sunlight. . . .

Further facts, details and suggestions are contained in a new, interesting VENTUBE Handbook just released. Write for it today. E. I. du Pont de Nemours & Co. (Inc.), "Fabrikoid" Division, Fairfield, Conn.

DU PONT
REG U.S. PAT OFF
VENTUBE
REG U.S. PAT OFF

*"Ventube" is Du Pont's registered trade mark for its rubber impregnated flexible ventilating duct.



FOR COAL PRODUCERS

TO PREVENT STREAM POLLUTION
TO RECOVER WASTE WATER FOR REUSE
TO RECOVER FINE SIZES
TO NEUTRALIZE ACID MINE WATERS
TO DESLIME AND RECOVER SLUSH

FOR many years Dorr equipment has been solving problems of clarification, neutralization and recovery in both the anthracite and bituminous fields.

During this period, we have built up a backlog of knowledge which enables us to tackle each problem individually and recommend equipment to suit your exact requirements.

If you are faced with a problem of fine size treatment, why not take advantage of what we have learned? You will find a Dorr engineer's recommendations based on facts gained from long experience.

DORR

RESEARCH ENGINEERING EQUIPMENT

ADDRESS ALL INQUIRIES TO OUR NEAREST OFFICE

DORRCO

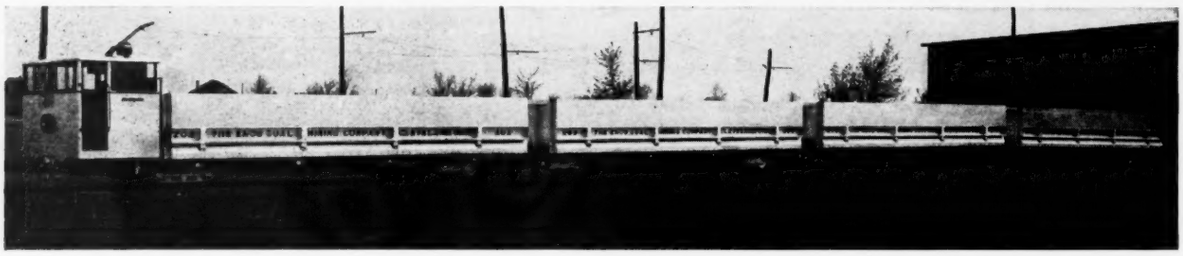
THE DORR COMPANY, INC., ENGINEERS

NEW YORK, N. Y. . . . 570 LEXINGTON AVE.
ATLANTA, GA. . . . . CANDLER BUILDING
TORONTO, ONT. . . . 80 RICHMOND ST.W.
CHICAGO, ILL. . . . . 221 NO. LA SALLE ST.
DENVER, COLO. . . . . COOPER BUILDING
LOS ANGELES, CAL. . . . 811 WEST 7TH ST.

RESEARCH AND TESTING LABORATORIES
WESTPORT, CONN.

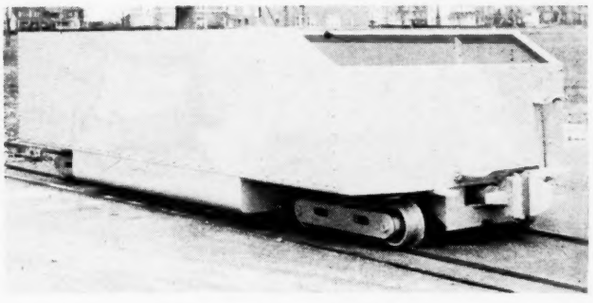
SUGAR PROCESSING
PETREE & DORR ENGINEERS, INC.
570 LEXINGTON AVE., NEW YORK

TO LOWER HAULAGE COSTS—USE DIFFERENTIAL EQUIPMENT

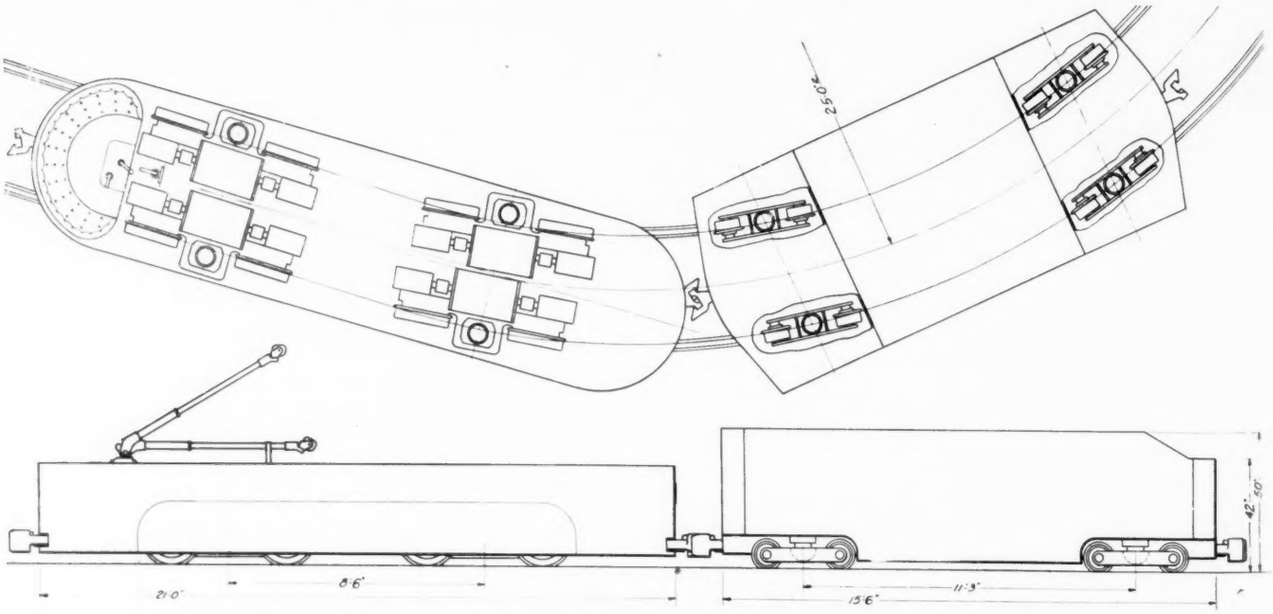


Powerful, light weight, alloy steel, high speed Differential Electric Trains revolutionize haulage methods. High pay load ratio and faster speeds require fewer trains. Differential AXLESS Trucks reduce train resistance due to better alignment of wheels with rails, independent rotation of wheels, less flange and tread and rail wear. Low center of gravity and better roadability permit higher speeds with safety. The above light weight Differential Electric Train attains 40 m.p.h. on AXLESS Trucks—makes 9.3 miles round trip every 30 minutes including loading and dumping 160 tons.

Differential 3-Way Dump Lorries are supplied in 7-yard and 15-yard sizes. One-man operation—3-way compressed air dumping builds dump without trestle or cribbing. Steep grades easily and safely negotiated.



Differential 8-Wheel AXLESS Mine Cars have greater capacity, better roadability, operate at higher speeds, and negotiate sharper curves. These Differential Cars require less drawbar pull, less power.



The above cut shows a 360 horsepower Differential 8-Wheel AXLESS Locomotive coupled to a Differential 10-Ton AXLESS Mine Car. Differential AXLESS Locomotives have more adhesion available for tractive effort and braking. Hence . . . . longer trains, higher speeds, and greater safety.

DIFFERENTIAL STEEL CAR CO., FINDLAY, OHIO

Built by
WESTINGHOUSE ELEC. & MFG. CO.

SKF

BALL AND ROLLER
BEARINGS

Move
COAL *quickly with* SKF's

With the conversion of many oil burners to coal burners along the East coast . . . with transportation facilities tied up by war plant and military needs . . . coal may shortly be "worth its weight in gold." So equipment like this 6-ton Westinghouse Trolley Locomotive is busy moving coal to the Tipple in preparation for the unprecedented demand. And by maintaining the original air gap, keeping the motor shaft properly positioned, and performing smoothly year in and year out, bearings like the SKF's on this locomotive's motor are eliminating common troubles which lead to costly shutdowns and loss of production. Designers of coal moving equipment simply can't afford to take chances with bearings these days. 5132

SKF INDUSTRIES, INC., FRONT ST. & ERIE AVE., PHILADELPHIA, PA.

"Repair and Maintenance" too often means valuable time lost on war jobs as the result of unnecessary breakdowns.

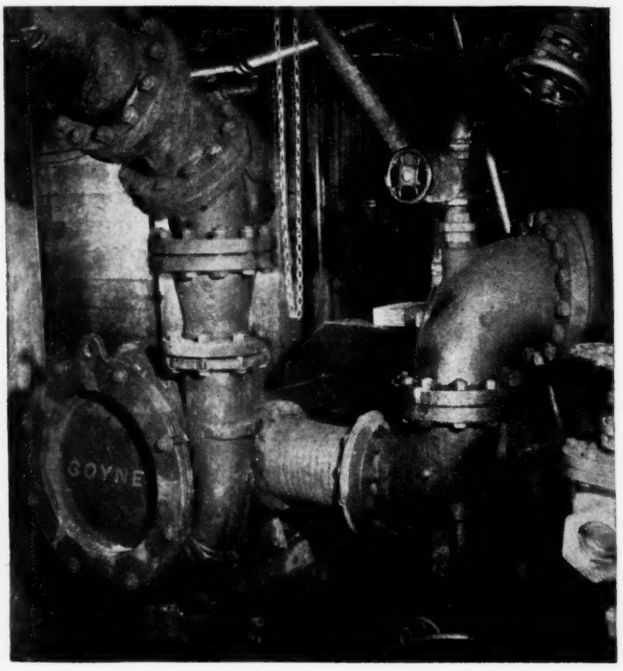
Today—industry cannot afford "time-outs" for repair and replacement of production equipment. Peak production must be maintained. That's why we recommend G-E Insulating Materials to protect your vital war production equipment.

G-E Insulating Materials keep repair and maintenance at a minimum. Let them do this tough job for you.

You can get complete information on G-E Insulating Materials from your nearest G-E Merchandise Distributor; or just write to Section M1023-10, Appliance and Merchandise Department, General Electric Company, Bridgeport, Connecticut.

GENERAL ELECTRIC

GOYNE PROCESS PUMPS



A Sand Pump is only a link in a chain in a coal washing plant, but it can be a strong link if it embodies the following features as does the Goyne:

1. Ease of inspection of all wearing parts. All internal portions are immediately accessible after removing only the rear head of the pump. No suction or discharge piping is disturbed.

2. The one packing box of the pump is subjected only to suction pressure and is readily kept clean by a low pressure clear water line. Long packing and shaft sleeve life is assured.

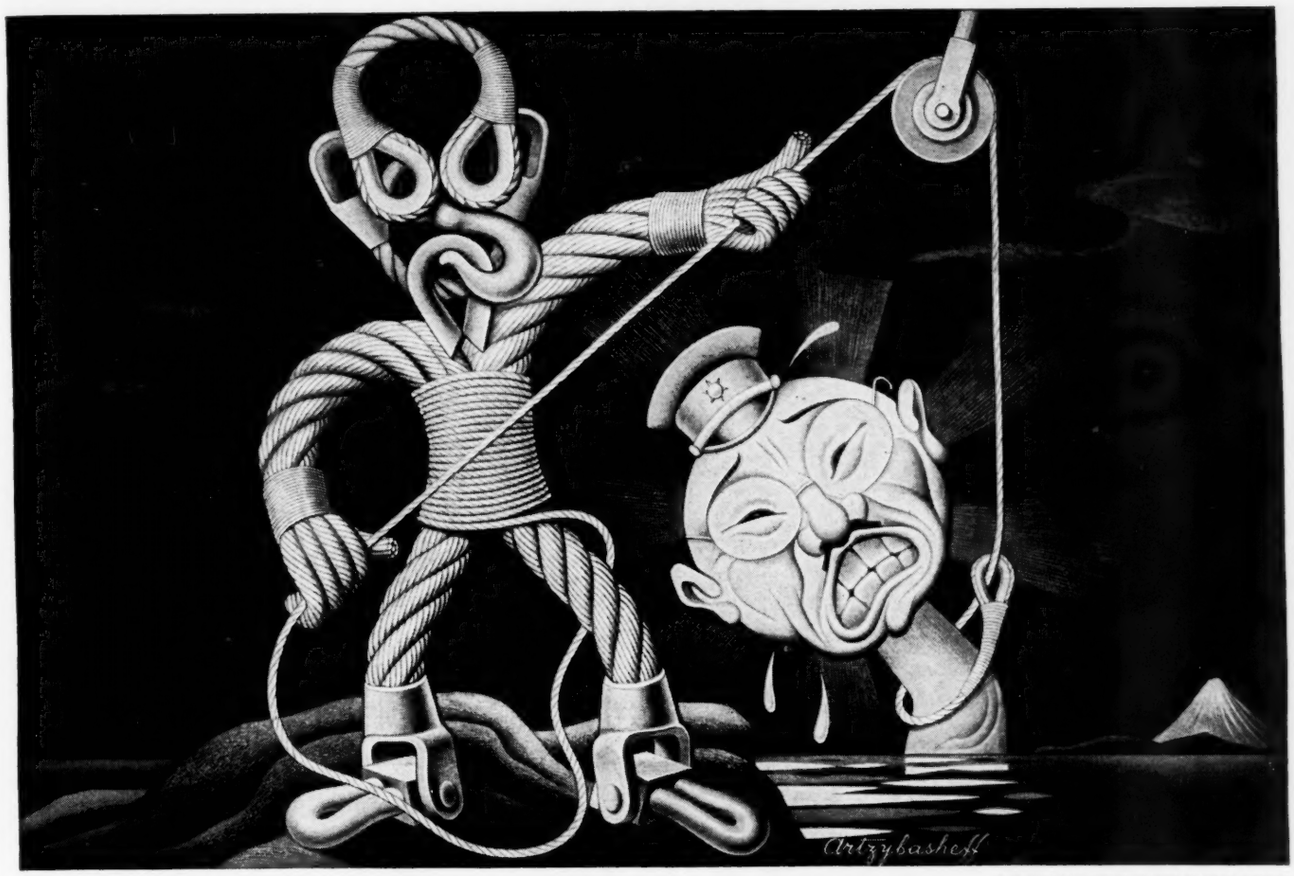
3. Impeller clearance is adjusted *while the pump is running*, insuring constant pump capacity so essential for uniform washing.

4. There are twenty-eight possible nozzle assembly combinations for each standard pump. Washery designers like this "adaptability feature" as it helps them out of tight places and simplifies piping.

5. We carry the spare parts stock. Order your replacements when needed. Reduce your inventory by using Goyne Process Pumps.

All inquiries receive prompt and careful attention.

THE GOYNE STEAM PUMP CO.
ASHLAND, PA.



POSTER REPRODUCTIONS AVAILABLE ON REQUEST. SEE COUPON.

COPYRIGHT 1942, WICKWIRE SPENCER STEEL COMPANY

YOU CAN HELP DO THIS JOB

Your country needs all possible steel for guns, tanks, ships and shells. All the *wire rope* that can be produced is needed for military and naval uses—and to speed war production in scores of industries. You can serve your country by taking care of *your* wire rope, so that replacement is postponed as long as possible.

FREE BOOK TELLS HOW

It illustrates and describes more than forty ways to *save money* on wire rope. The big pictures of right and wrong ways make it easy to spot sources of too rapid wear—and *correct* them.

Many thousands of wire rope users throughout the world use this handy book as their guide to longer wire rope life. Now, with urgent war needs for steel and wire rope, it is doubly important that every wire rope user have a copy.

If you *must* have new wire rope to maintain uninterrupted war production, help us to help you by anticipating your needs as far in advance as possible, within priority regulations.

WICKWIRE WSS WISSCO PRODUCTS

WICKWIRE ROPE

Sales Offices and Warehouses: Worcester, New York, Chicago, Buffalo, San Francisco, Los Angeles, Tulsa, Chattanooga, Houston, Abilene, Texas, Seattle. Export Sales Department: New York City.

MAIL THIS COUPON

Wickwire Spencer Steel Company
500 Fifth Avenue, New York, N. Y.

☐ Send free copy of the book, "Know Your Ropes."

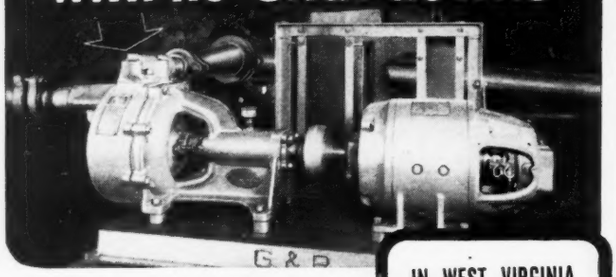
☐ Send ..... free posters, 21" wide, of illustration at top of this page. No advertising appears, merely prize-winning title, "I Pull with Uncle Sam."

Name .....

Company .....

Address .....

it PUMPS 24 hours a day with no "shut downs"



The keynote of the dependable G & R Mine Gathering Pumps is the word "simplicity". Because of greater simplicity (only one moving part — the impeller), these Self-Priming Centrifugals will pump more water, more continuous hours, per dollar invested than any other type. No valves to clog; no cylinder liners to be cut out; no gears, cams, levers, etc., to wear, break, or cause trouble. Pumps operate at motor speed. Capacities up to 220 GPM; heads up to 125 ft. Our engineering department will survey your requirements and make recommendations or write for Bulletin MP-2. It's free.

See our catalog data in Coal Mining Catalogs

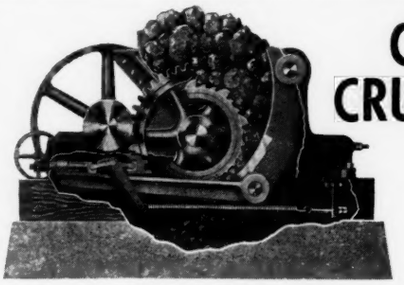
IN WEST VIRGINIA

the Koppers Company are replacing old pumps as they wear out with G & R self-priming centrifugal mine gathering pumps. At the Helen, Stanaford, Kimball, Stotesbury and Kopperstown Mines 36 G & R Pumps of varying capacities are daily proving their simplicity and dependability.

Distributors in all principal Mining Areas.

GORMAN RUPP PUMPS — UNSURPASSED FOR PUMPING FAST

THE GORMAN-RUPP CO.
MANSFIELD, OHIO



COAL CRUSHERS

We build a type and size for every coal crushing requirement. 100 years of experience is your assurance that we know how. Quotations on request.

McLANAHAN & STONE CORP
Established 1835 HOLIDAYSBURG, PENNA.

HENDRICK
Carbondale **1600**
for
PERFORATED PLATE

Round—Square—Diagonal—Slot
Any perforation

HENDRICK MANUFACTURING CO.
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PERFORATED METAL
COAL MINING SCREENS
Manufactured exactly to your specifications
Any size or style screen, in thickness of steel wanted with any size perforation desired.
We can promptly duplicate your present screens at lowest prices.

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MAN-power . . . . . "MP"

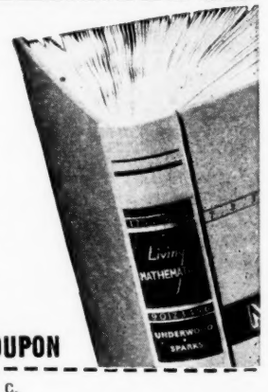
It takes Man-Power to make modern organization and equipment effective. The Man-Power of the industry served by COAL AGE is the experienced personnel included among the 12,000 subscribers of this paper. If your organization needs MAN-power, you can locate the best man, or men, available through a Position Vacant Advertisement in the SEARCHLIGHT SECTION of COAL AGE.

Mathematics made plain
—and easy to learn—and amusing

THAT is the purpose, completely realized, of this new mathematics text. The authors begin (with a humorous story) right on the edge of the Unknown where arithmetic can no longer show the way. After a thorough course in algebra they take you on a survey of the highlights of trigonometry, analytic geometry, more advanced algebra, and calculus, with a seasoning touch of the theory of numbers. The style is light, the explanations are detailed and the book makes highly interesting reading.

LIVING MATHEMATICS

By R. S. Underwood and Fred W. Sparks, *Texas Technological College.* 365 pages, 6 x 9, $3.00



HERE is just the book for: Those who have met with initial failure in trying to master the intricacies of the subject; and now, as adults, can be expected to make real headway when the subject is presented as a fascinating pastime.

Those who 'took to it' readily when first presented; and now wish to pick up the threads and go on to higher mathematics,—the calculus and number theory.

In this book you will find drama, zest, humor, surprise, challenge and human interest.

10 DAYS TRIAL—SEND THIS COUPON

McGraw-Hill Book Co., 330 W. 42nd St., N. Y. C.
Send me Underwood and Sparks' Living Mathematics for 10 days' examination on approval. In 10 days I will send $3.00, plus few cents postage, or return book postpaid. (Postage paid on cash orders.)

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Fig. 0851
250 lbs. steam pressure

Instead of the usual wedge or disc, Fairbanks Sphero has a revolving ball plug which wipes the seating surface clean. Its shearing action cuts through heavy solids and liquids. There is nothing on which foreign matter can accumulate.

The opening in the ball plug is the same size as that in the pipe. There are no obstructions, no frictional resistance. It's clear sailing for steam, oil, water, etc.

Wear on seat rings is reduced to a minimum by the rotary motion of the ball. And seat rings can be kept permanently tight by adjusting the wedge at bottom.

It can be opened or closed as "quick as a wink" by the long lever handle. A positive stop tells when fully open or closed.

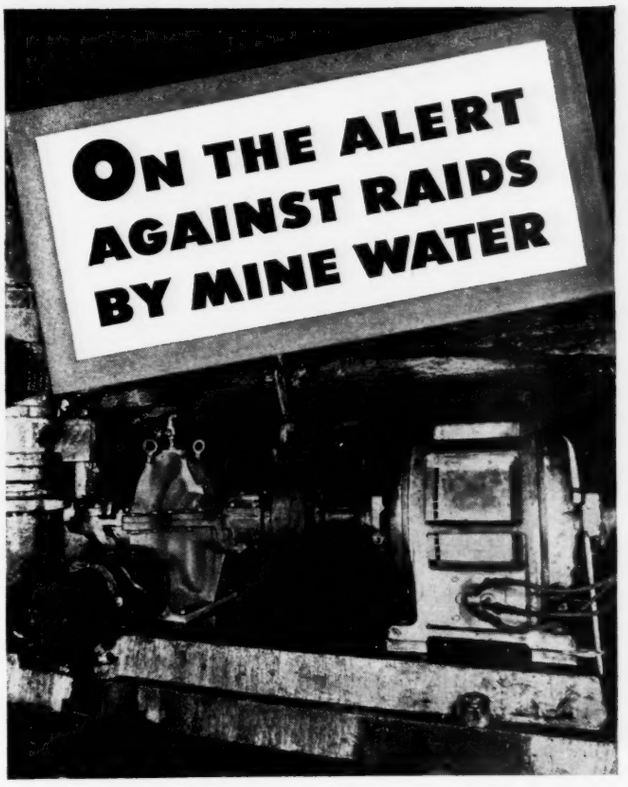
Seat rings or other parts which may become worn, can be replaced without removing valve from the line.

Try just one Fairbanks Sphero Valve for blow-off purposes and services where a full flow, quick-acting valve is desired and you'll wish you had used them before.

Send for Catalog No. 21 and name of our nearest distributor.

THE FAIRBANKS COMPANY
388 Lafayette St., New York, N. Y.
Boston, Mass., Pittsburgh, Pa.
Distributors in Principal Cities

Fairbanks Sphero Valves

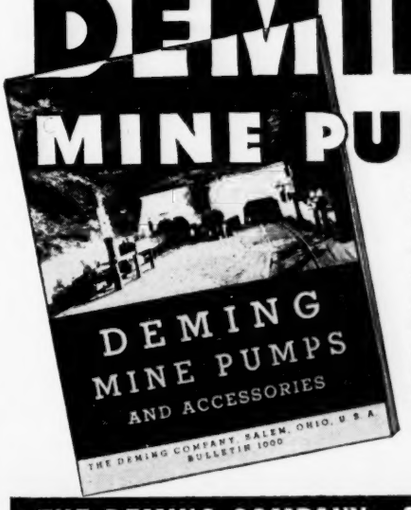


Mine water hasn't a chance when the Deming Double Suction Centrifugal Pump illustrated goes into action at the Rosedale Coal Company near Morgantown, W. Va.

On guard 162 feet below the surface, the Deming Pump drives mine water against that head as long as required to rid the mine of the "enemy water."

There's a right type and correct size of Deming Mine Pump for every dewatering condition. Investigate by sending for the free Bulletin illustrated in miniature below.

DEMING
MINE PUMPS



Selection of the right type and size of Deming Mine Pump for a specified requirement is simplified by Bulletin 1000. Send for a copy.

THE DEMING COMPANY • SALEM, OHIO

Now 65
~~25~~ YEARS
OF "KNOW HOW"
go into Westco Pumps

Westco, the original horizontal turbine type pump with renewable liners, having established an outstanding performance record during the past 25 years on hundreds of thousands of applications, is now ready for even greater service.

For now the engineering "know how" of Pomona Pump Co.'s 40-year leadership in the industry have been added to Westco's background, resulting in a still better, tougher, longer-lived pump. Production has been stepped up far beyond any previous record—and wider distribution has resulted, much of it in new fields.

With this 65 years of combined pump "know how" behind it, your installation of a Westco Pump inherits a legacy of value *doubly* important in checking on pump equipment today!

Distributors in all principal cities or write us direct.

POMONA PUMP CO.
WESTCO DIVISION
2621 Locust Street • St. Louis, Missouri

With Westcos, simply renew the liners (arrows) and you renew the pump!

R AND S COMPANY

Equipment
FOR YOUR PARTICULAR JOB..

THERE is no other coal cleaning job exactly like yours.

R and S understands this and is prepared to recommend equipment that specifically meets your problem.

The following bulletins that outline some R and S equipment are available.

Write for them today

HYDRO-SEPARATOR
No. 156—FOR COARSE COAL
HYDROTATOR
No. 157—FOR FINE COAL
STUMP CLEANER
No. 158—FOR DRY CLEANING

There is no obligation

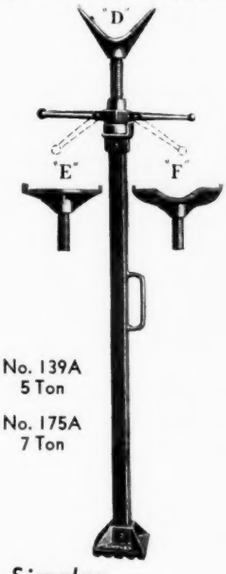
ROBERTS and SCHAEFER CO.
307 North Michigan Avenue, Chicago
P. O. Box 865 PITTSBURGH, PA. | 1711 Connecticut Avenue, N. W. WASHINGTON, D. C. | P. O. Box 570 HUNTINGTON, W. VA.

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

Simplex Mine Timber Jacks

Help Koppers Safely Mine 12,000,000 Tons a Year!

It takes adequately protected and properly equipped miners to produce that kind of tonnage. The use of Simplex Mine Timber Jacks by the Koppers Coal Co. is typical of the steps they have taken to maintain their enviable production and safety records.



No. 139A
5 Ton
No. 175A
7 Ton

Simplex Mine Timber Jacks safely support timbering until roof jacks are placed or as safety prop under dangerous roof conditions. Used also to renew mine locomotive journal brasses when over a pit. They have many other mine uses. Available with three types of heads.

Get the full story of Simplex-Gold Medal Award for Safety-Mine Jacks in Bulletin "Mines-42."

Templeton, Kenly & Co.
California, Pa. Chicago, Ill. Princeton, W. V.
Better, Safer Mine Jacks Since 1899

Simplex
LEVER - SCREW - HYDRAULIC
Jacks

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UNDISPLAYED RATE:

10 cents a word, minimum charge $2.00.

(See ¶ on Box Numbers.)

POSITIONS WANTED (full or part-time salaried employment only), ½ the above rates.

PROPOSALS, 50 cents a line an insertion.

INFORMATION:

BOX NUMBERS in care of any of our New York, Chicago or San Francisco offices count 10 words additional in undisplayed ads.

DICOUNT of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

DISPLAYED—RATE PER INCH:

The advertising rate is $6.30 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches —to a page. C.A.

NEW ADVERTISEMENTS received by 10 A. M. October 27th will appear in the November issue, subject to limitaticns of space available.

FOR SALE

COAL MINE

Fully equipped anthracite coal mine, lower field, with breaker and all machinery for complete operation. All machinery in first class condition. Now producing 200 tons per day. Breaker capacity 400 Tons. Lease on 420 acres. Additional virgin coal lands adjacent can be leased. Communicate with

J. L. N. CHANNELL, Attorney
207 Thompson Bldg. Pottsville, Pa.

WE LOOK INTO THE EARTH

By using Diamond Core Drills. We drill for Limestone, Gypsum, Talc, Fire Clay, Coal and all other minerals.

PENNSYLVANIA DRILLING CO.
Drilling Contractors
Pittsburgh, Pa.

FOR SALE OR LEASE

1000 acres of coal in Buchanan County, Va. Two miles front on N. & W. Rway. 3 seams, 40, 50 and 75 inches.

Analyses:	
Moisture	0.65%
Volatile Matter	29.99%
Fixed Carbon	66.59%
Ash	2.86%
Sulphur	0.64%
B. T. U. Det.	14,676

J. G. & GEORGE BUSTON, Owners
Tazewell, Virginia

DIAMOND CORE DRILLING, for any mineral. More than sixty gasoline, steam and electric drills, suitable for any job. **OUR SPECIALTY—testing bituminous coal lands.** Satisfactory cores guaranteed. Prices very reasonable.

HOFFMAN BROS. DRILLING CO.
PUNXSUTAWNEY, PA. Est. 1902 Tel. 332

WANTED

-TRANSFORMERS-

TRANSFORMERS WANTED

in operating condition or burnt out. Mail us list giving complete nameplate data and stating condition.

We Rewind, Repair and Redesign all Makes and Sizes
ALL TRANSFORMERS GUARANTEED FOR ONE YEAR
We invite your inquiries

THE ELECTRIC SERVICE CO., INC.
"AMERICA'S USED TRANSFORMER CLEARING HOUSE"
STATION M Since 1912 CINCINNATI, OHIO

WANT TO BUY

1 to 6 **Tyler or Hammer Vibrating Screens**
1—30x30 or 2 smaller roll type **Coal Crushers.**
1—200 to 300 KW **M.G. Set.**
1—50 to 60 Ton **Locomotive.**
20 Ton or Larger **Locomotive Crane.**
1—**Rotary Dryer,** 5x60 or equal.
2—1200' or equal **air compressors.**
3—60,000 & 25,000 gallon **Tank on Steel Towers.**

RUSSELL STANHOPE
60 East 42nd Street New York, N. Y.

WHEN *Answering Advertisements*

PLEASE *do not send original letters, certificates or photographs. We cannot be responsible for their return. Please send photostat or carbon copies.*

Conway Shovel

WANTED

To drive tunnel 12 feet wide by 8 feet high

Track gauge—28", 30" or 36".

Electric supply—230-250 volt D.C.

Conway Type 125 preferred, not over 6' 6" high above the rail.

The Hudson Coal Company
Scranton, Pa.

POSITION VACANT

WANTED—By large organization, man or woman familiar with leading companies in coal industry, and able to undertake analytical work. Must be able to write clearly and concisely for publication. Reply should outline applicant's age, education, experience, number dependents and salary desired. P-652, Coal Age, 330 W. 42nd St., New York, N. Y.

WANTED—Stripping contractors for large operation in eight foot Pittsburgh coal in Northern West Virginia. Conditions favorable. P-654, Coal Age, 520 N. Michigan Ave., Chicago, Ill.

POSITIONS WANTED

SUPERINTENDENT, ENGINEER — technical graduate, 22 years experience as superintendent, chief engineer, safety engineer, construction, shaft sinking, mechanization, coal washing. Similar position wanted. PW-634, Coal Age, 520 N. Michigan Ave., Chicago, Ill.

MINE MANAGER OR SUPERINTENDENT. Twenty five years experience as manager and Superintendent of coal mines. First class Mine Manager's Certificate for Illinois. Familiar with mechanical loading equipment. Best references. PW-647, Coal Age, 520 N. Michigan Ave., Chicago, Ill.

CIVIL AND MINING ENGINEER wishes connection with Progressive company, can take full charge of Engineering and Production Departments, 24 years practical experience Anthracite, Bituminous Foreman Certificates. Married, age 44 years. References. PW-648, Coal Age, 330 W. 42nd St., New York, N. Y.

ACCOUNTANT—years of varied experience, age 54, desires connection at mine office. Physically handicapped in walking but good health. PW-653, Coal Age, 330 W. 42nd St., New York, N. Y.

BUSINESS OPPORTUNITY

Rail-River Coal Mines

In midwest available on lease basis. Address BO-628, Coal Age, 520 N Michigan Ave., Chicago, Ill.

Lease On Royalty

COAL MINES and Acreage, Fire-Clays and Iron-Ores for lease on royalty. Cornett-Properties, P.O. Box 235, Grayson, Kentucky.

CONTRACT WORK

EXCELLENT OPPORTUNITY for a coal stripping contractor with 5-yard Walker Dragline for an operation in Northern Illinois. Also, unusual opportunity for two-yard Dragline or larger for extensive acreage in Ohio. Excellent coal, desirable stripping conditions, long term contract. Hott Coal Company, Dover, Ohio. Phone 3-5801.

FOR SALE

JOY LOADER, Bradford Breaker Outfit. Four 12 Cubic Yard Sidedump Railroad Cars. Two Skips or Cages. Hoisting Engines. Steel Headframe with Sheaves. FS-627, Coal Age, 520 N. Michigan Ave., Chicago, Ill.

WANTED

ANYTHING within reason that is wanted in the field served by Coal Age can be quickly located through bringing it to the attention of thousands of men whose interest is assured because this is the business paper they read

6 YD. STRIPPER SHOVEL

200-B Bucyrus 6 years old. 75 ft. Boom, 60 ft. Dipper stick, 6 yd. Dipper Steam Shovel.

LIGHT PLANT

4 KW Kohler 120 V—Gasoline Lighting Plant.

DIESEL DRAGLINES

3W 4W & 5W Monighan Walkers, 90 to 110 ft. booms.
3 Yd. P.&H. 800, 97' boom.
2½ Yd. 48B Bucyrus 80' boom.
2 Yd. 750 Lima, 60' boom.

AIR COMPRESSORS:
(7) Steam 66 ft., 300 ft., 600, 1000 & 1940 ft.
(12") Belted, 360, 676, 870, 10000, 1300 ft.
(12) Diesel 105, 315, 520, 676 & 1000 ft.
(6) Electric, 1300, 1500, 2200, 2600, 5000 ft.
(14) Gasoline, 110, 160, 220, 310 & 370 ft.

COAL CRUSHERS:
Jeffrey Single Roll 18x18, 24x24 & 30x30
Link Belt 26x24 Double Roll Crusher

HYDRAULIC CARWHEEL PRESSES:
100 Ton, 150 Ton, 300 Ton, 300 & 400 Ton Caldwell - Niles - Wood - Watson Stillman

RUBBER CONVEYOR BELTS:
1000' 60", 600' 30", 300' 20", 1600' 42", 900' 48", 1450' 36", 1200' 24", 900' 18", 600' 16", 350' 14".

CONVEYOR PARTS:
Idlers, Head & Tail Pulleys, Steel Frames, Tripper, etc., 14 In., 60 In. Large Stock here.

SYNC. MOTOR GENERATORS & ROTARYS:
100 KW Ridgway 1200 RPM 3/60/2300/250-275
150 KW G.E. 1200 RPM 3/60/2200-250-275
200 KW Ridgway 900 RPM 3/60/2200-250-275
3—100 KW G.E. 275 v. 1200 RPM Rotarys

STORAGE BATTERY LOCOMOTIVES:
2½ ton Whitcomb 24 ga. New Batteries
2—4 ton G.E. 30 in. ga.
3—5 ton Mancha 30 in. ga.
4—5 ton G.E. 36 in. ga.
3—7 ton Goodman 36 ga. Battery & Trolley
8—6 ton Baldwin Westgh. 42 ga. & 36 ga.

TROLLEY LOCOMOTIVES:
2½ ton Westinghouse 24 ga.
4—6 ton & 3—5 ton Goodman 36 ga.
3—6 ton Goodman 30 ga.
4—6 ton Goodman 42 ga.
5—6 ton Westinghouse 42 ga.
2—8 ton Goodman 36 ga.
10 ton Goodman 42 ga. & 13 ton Jeffrey

VIBRATING SCREENS:
9 Tyler Hummer 3x6, 4x5, 4x8 & 4x10
2 Robins Gyrex 4x8½
4x12 Niagara, 3x8 L. B., 5x6 Simplex

CARS:
120—4 ton 42 ga. S.D. Mine Cars
60—Western 16-20-30 yd. Side Dump

SHOVELS, CRANES & DRAGLINES:
3 W 90' Boom, 6 W 160' Boom, Model 6150, 175' Boom, Diesel, Monighan Walkers
1 yd. K 30 Link Belt 50' Boom Crane
2 yd. Page 70' Boom Diesel Dragline
1¼ yd. Marion 450 Elec. Shovel
1½ yd. Lima Diesel Shovel & Dragline
2 yd. Link Belt Elec. Shovel & Dragline
25 ton Browning 50' Boom Loco. Crane
7 Conway 20A, 30A, 50A, 60 & 75 Muckers

MINE LOADERS:
Junior Joy 36 ga. Low Pan
Conway 20 Mucker
3—5 BU & 7 BU 36 or 42 ga. Joy
9—Goodman 200 & Jeffrey 441

MISCELLANEOUS:
5'x160' Traylor Rotary Dryer
100 HP G.E. 3/60/440 v.-900 RPM Elec. Motor
6 Goodman 12CA & 12DA 6 ft. Cutters
9x8 Sullivan Mine Compressors
Clamshell Buckets ¾, 1, 1½ & 2 yd. Cap.
30 ton & 12 ton Vulcan Std. Ga. Gas. Loco.

WANTED TO BUY:
Complete Mines—M.G. Sets, Locomotives, Compressors, Conveyors, Cranes, Crushers & Rotary Converters. Also Rails, Screens, Pumps, Cars, Mine Loaders & Mining Machines.

Tidewater Equip. & Machy. Corp.
305 Madison Ave. New York, N. Y.

FOR SALE

JOY LOADING MACHINES

15—5-BU Joy Loading Machines, 250 volt DC. Just taken out of service—in excellent condition. Have been loading 450-ton of coal per shift.

STEEL MINE CARS

100—2½-ton, 42" gauge rotary dump mine cars in perfect operating condition. Height overall 38", length 122", width 62½", length of body 98", 90 cu. ft. level full, 16" Timken Bearing Wheels, link and pin couplers, 4-wheel brakes, equipped with car haul bracket on bottom, Toncan Copper Bearing Steel used in sides and ends.

ELECTRIC HOISTS

1—300 H.P. Nordberg Shaft Hoist, cylindro-conical drum, 225' lift.
1—1300 H.P. Vulcan Shaft Hoist, 1600' lift, cylindro-conical drum.
1—1300 H.P. Ottumwa Shaft Hoist with double cylindro-conical drums, suitable for 675' lift.

STEEL TIPPLES

1—LINK-BELT practically new re-screening plant, all steel structure, 100-tons.
We have several 3, 4 and 5-track steel tipples for slope, shaft and drift mines.

SHORTWALL MINING MACHINES

15—Jeffrey 35-A, 50 HP., 250 volt DC, 7½' cutter bars.
7—Sullivan CE-7 AC Shortwall Mining Machines, 7½' cutter bars, self-propelled trucks and cable reels.

LOCOMOTIVES

27—6, 8, 10 and 15-ton completely rebuilt and some slightly used locomotives. Any type, make or gauge that you are looking for.

Frank J. Wolfe

We Specialize in Buying Complete Mines That Are Going Out of Business or From Receivers in Bankruptcy, Administrators of Estates, Etc.

COAL MINE EQUIPMENT SALES COMPANY
306-7 Beasley Building L. D. Phone 34 Terre Haute, Indiana

MINING EQUIPMENT

1—100 KW, 250/275 volt, DC, G.E. Rotary Converter with 2300 volt Transformer and manual switchboards.
1—200 KW, 550/600 volt G.E. Converter.
1—Motor-Operated Brush Raising Mechanism for Rotary Converter.
3—165 KVA, 6600-445 volt G.E. Rotary Converter Transformers.
(Can be rewound for desired voltage)
3—55 KVA, 2300/4000Y, G.E. Rotary Trans.
1—Ingersoll-Rand Portable Air Compressor with texrope "V" belt drive.
Motors, 3 to 50 HP, AC & DC in stock. Different types, speeds and voltages.
1—Westinghouse Voltage Regulator 120 volt, AC, 60 cycle, 120 volt, DC.
Rotary Switchboards built to order.

R. H. BENNEY EQUIPMENT CO.
5024 Main Ave. Norwood, Ohio

FOR SALE

SHOVELS-TRUCKS-COMPRESSORS

1—Model 1201 Lima High Lift Shovel 42' boom, 32' dipper sticks, 2½ cu. yd. dipper, NKH Hesselman oil engine. Machine convertible to crane or dragline. Machine rebuilt and guaranteed.
1—Model 480 2 yard Marion Steam Shovel. Good working order.
1—FD Euclid 10 yard rear dump truck—Cumins Diesel engine. Rebuilt and guaranteed.
1—D99 Hug 15 yard rear dump Boulder Dam type truck. 10 wheels. Rebuilt and guaranteed.
1—Ingersoll Rand 315 cu. ft. Air Compressor—Hesselman oil engine. Truck mounted. Rebuilt and guaranteed.
1—Worthington 215 cu. ft. Air Compressor—Hercules Diesel engine. Truck mounted. Rebuilt and guaranteed.
1—2 Cu. yd. Page RH dragline bucket, completely rebuilt.
1—2½ Cu. Yd. Bucyrus dragline bucket Rebuilt.

FRANK SWABB EQUIPMENT COMPANY
HAZLETON, PA.
Telephone 3906

PIPE—MACHINERY—GAS ENGINES
AIR COMPRESSORS—DIESELS—PUMPS

Some Steam Engines and Boilers available only slightly above the metal price

BRADFORD SUPPLY COMPANY
WAYNE, WOOD COUNTY, OHIO Near Toledo

WE BUY AND SELL
MOTORS
TRANSFORMERS
MOTOR GEN. SETS
OIL SWITCHES
AIR CIRCUIT BREAKERS

ELECTRIC EQUIPMENT CO.
678 Lake Ave., Rochester, N. Y.
Tel: Glenwood 6783

LINK-BELT UNLOADING TOWER

SUITABLE FOR COAL OR ORE

GANTRY TYPE • CAPACITY 750 T.P.H.
RAIL SPAN 44' • OVERALL HEIGHT 114' WIDTH 166'
COMPLETE WITH WIRING AND 8 SELF-CONTAINED 3 PHASE MOTORS AND BUCKET

ERMAN-HOWELL & CO., INC.
332 S. MICHIGAN AVE. ***CHICAGO, ILL.***

REBUILT EQUIPMENT—READY TO SHIP

MINING MACHINES
CE-8 Sullivan 250 v. DC.
CE-7 Sullivan Shortwall 250 v. 6' bar

MINE LOCOMOTIVES
6 ton Atlas 220 v. 3 ph. 60 cy. 36" ga.
10 ton Milwaukee GASOLINE

ROTARY CONVERTERS
1—500 kw. G.E., type HC-8, 600 volt, 900 rpm. complete with transformers and switchboards.
200 kw. G.E. 275 v. DC 900 rpm. complete with transformers.

TRANSFORMERS—1 ph. 60 cy.
3—1500 kva, 22000, 6600 Pgh.
1—220 kva, 2300, 115/230 All. Ch. 3 ph.
3—150 kva, 22000, 6000 Pgh.
1—150 kva, 2200, 230/460 G.E. 3 ph.
1—100 kva, 2200, 110/220 G.E. 3 ph.
1—100 kva, 2200, 110/220 West.
3—100 kva, 6600, 550/440/220 Pgh.
1—100 kva, 2200, 220/110 West.
2—75 kva, 2200, 220 Burke 3 ph.
2—50 kva, 2300, 220/440 G.E. 1 ph.
3—50 kva, 11430/6600, 550 Al. Ch.
3—50 kva, 6600, 575 G.E.
1—50 kva, 2200, 220 Burke
3—50 kva, 2200, 110/220 West.

SPEED REDUCERS
Thomas, 3 HP ratio 100:1
Falk, 150 HP ratio 7:31 to 1.
Kerr, 275 HP ratio 3800 rpm. to 720 rpm.

230 V, D.C. MOTORS

HP.	Make	Speed
125	G.E.	1750 rpm.
100	West.	250
85	G.E.	530
75	West.	1700 rpm.
75	West	475
75	Reliance	1750
50	West.	975 rpm.
50	West.	1700 rpm.

M. G. SETS—SYNCHRONOUS
200 kw. West. 600 v. DC 600 rpm. 2300/3/60.
150 kw. West. 275 v. DC 600 rpm. 2300/3/60.
125 kw. Cr. Wh. 250 v. DC 1200 rpm. 220/440/3/60 Ind.
30 kw. West. 60 v. 1750 rpm. dir. con. 220/440/3/60/Ind.

A.C. GENERATOR—3 ph. 60 cy.
219 kva G.E. 2200/440/220 v. 200 rpm.

HOISTS
25 HP. Thomas 18" face 20" dia.
40 H.P. single drum AC 220/3/60.
100 H.P. Lidgerwood 2 drum AC or DC Motor

CENTRIFUGAL PUMPS
4x3 Harris, 329 rpm.
4x4 Weinman, 500 gpm.
6x6 Gould, bronze, 1300 gpm.
8x8 Weinman, bronze.
5x6 Hayton, 750 gpm.
6x6 Manistee, 750 gpm.
6x6 American, 1000 gpm., bronze.
6x6 Weinman, 1000 gpm.

ENGINE GENERATOR SETS
50 kw. 250 V. D.C. Generator direct connected to International Diesel Engine.
50 kw. West. 220/3/60 Ames STEAM
75 kw. G.E. 220/3/60 Bessemer GAS.
75 kva. Allis Chal. 220/3/60 dir. con. 14x14 Steam Engine.
80 kw. West. 250 V. Belted 110 Bessemer GAS.
175 kw. G.E. 2200/3/60 Ridgway STEAM.
225 kw. Elec. Machy. 2300/3/60 Ideal STEAM.

TURBINE
1—Kerr Steam Turbine 450 RHP 3800 rpm., 5" intake 12" exhaust with Kerr Reduction Unit 3800 to 720 rpm., 115# pressure.
1—1000 kw. G.E. Turbo 6600/3/60 150# Pres.

SLIPRING MOTORS—3 ph. 60 sy.

No.	HP	Make	Type	Volts	Rpm.
1	1500	Allis. Chal.	ANY	2200	485
1	700	G.E.	MT-432	2200	393
1	400	West.	CW	2200/550/220	435
1	400	West.	CW-967A	220/440	1170
1	300	G.E.	I-M	220/440	600
1	260	Burke	EMV-65	220/440	600
3	250	G.E.	I-M	550	600
3	250	G.E.	I-M	2200/220/440	600
3	200	G.E.	I-M	2200/220/440	600
1	200	G.E.	I-M	2200	514
1	200	West.	CW-956A	2200	690
1	150	G.E.	I-M	220/440	900
1	100	West.	CI	220/440	1750
1	75	West.	CI	220/440	860
1	60	Triumph	C-16	220/440	430
2	60	G.E.	MT-536	2200	1150
1	52	G.E.	ITC-5013	220/440	570
2	50	Allis Chal.	ANY	220/440	900
1	50	West.	HF-12A	220/440	900
1	50	West.	CW-461	220/440	900
1	50	G.E.		220/440	850
2	50	West.	HF	220/440	1120
1	50	West.	CW-636A	220/440	1150
2	40	G.E.	MT-332	220/440	1155
1	40	G.E.	MTC-5522	220/440	1125
1	40	G.E.	MT-342	220/440	860
1	40	Allis Chal.		220/440	685
1	40	G.E.	MT-552	220/440	575
1	25	West.	MW	220/440	680
1	25	West.	CI	220/440	870

SQUIRREL CAGE MOTORS—3 ph. 60 cy.

HP	Volts	Make	Type	Speed
500	2200/440/220	West.	CS	720
400	2200/440/220	West.	CS	500
450	2200/440/220	West.	CS	600
400	2200/440/220	West.	CS	600
350	2200/440/220	West.	CS	450
300	2200/440/220	West.	CS	400
200	2200/440/220	West.	CS	250
200	220/440	West.	CS	580
200	2200	West.	CS	870
150	550/220/440	G.E.	—	575
150	220/440	G.E.	KT-562	690
150	2200/440/220	Al. Ch.	Syn.	1200

DUQUESNE ELECTRIC & MFG. CO. . . . . PITTSBURGH, PA.

MINING MACHINES
Goodman Standard & Universal.
AC & DC Rebuilt & Guaranteed.

MINE LOCOMOTIVES
5 to 20 ton.

STRIPPING SHOVELS

M. G. SETS & ROTARY CONVERTERS

PUMPS and FANS

COAL CRUSHERS

Will buy, sell or exchange. What do you need?

The Industrial Equipment Corp.
Warehouse: Carnegie, Pa.
P. O. Box 1647 Pittsburgh, Pa.

MINE HOISTS

1—Diamond 12" Drum 20 HP electrical equipment.

1—Vulcan 30" Band Friction with 50 HP electrical equipment.

1—Flory 48" Band Friction with 150 HP electrical equipment.

1—Connellsville 54" Drum Haulage Hoist with 100 HP electrical equipment.

1—Lidgerwood Cylindo-Conical Drum 200-1¼ with 350 HP electrical equipment.

1—Vulcan Cylinder Conical Drum Shaft Hoist, 350 ft. 1⅜" rope with 400 HP motor and control.

1—Nordberg Cylindro-conical Shaft 400 ft. 1½" rope with 600 HP motor and control.

And other hoists to suit all mining conditions

Jones Mining Equipment Co.
541 Wood Street Pittsburgh, Pa.

ROTARY CONVERTERS

500 KW WEST. SYN. 275 V., 6 Ph., 60 Cy., 1200 RPM, Pedestal type, 2300/4000 V. Transformers.

500 KW G.E. SYN. 575 V. HCC, 6 Ph., 60 Cy., 1200 RPM, form P, 2300/4000 V. Transformers.

200 KW AL-CH SYN. 275 V. 6 Ph., 60 Cy., 1200 RPM, Pedestal Type, 2300/4000 V. Transformers.

150 KW R.W. SYN. 275 V., 6 Ph., 60 Cy., 1200 RPM, Pedestal type, 440/2300/4000 V. Trans.

MOTOR GENERATORS

200 KW G.E. IND., 275 V., 440 V., 3 Ph., 60 Cy., 720 RPM, Manual Switchgear.

200 KW G.E. SYN. 600 V. 2300/4000 V. 3 Ph. 60 Cy. 80% P.F. 720 RPM Manual Switchgear.

200 KW R.W. SYN. 275 V. 2300/4000 V. 3 Ph. 60 Cy. 80% P.F. 900 RPM. Manual Switchgear

LOCOMOTIVES

13-T JEFFREY, 250 V., MH-110 Mts., 44"-36" Ga.
10-Ton GOODMAN, 250 V., 29-A Mts., 44"-36" Ga.
6-Ton JEFFREY, 250 V., MH-88 Mts., 42"-36" Ga.
6-Ton WESTGHE, 250 V., 904-C Mts., 42"-36" Ga.
5-Ton WESTGHE, 250 V., 902-B Mts., 56½" Ga.
4-Ton WESTGHE, 250 V., 902-C Mts., 36" Ga.
4-Ton GOODMAN, 250 V., 42-I Mts., 44" Ga.

Each unit listed above is owned by us and is available now for immediate purchase.

WALLACE E. KIRK COMPANY
Incorporated
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RAILS—CARS
All sections of rails and good serviceable second hand cars, all gauges, also spikes, bolts, frogs, switches and ties.

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RELAY RAILS . . . *Shipments from Stock*
50 lb.—56 lb.—60 lb.—70 lb.—80 lb.
Splice Bars Lock Washers Tie Plates Bumping Posts
Track Bolts Track Spikes Cross Ties Frogs and Switches
E. C. SHERWOOD, 46 Church St., New York Tel. CO 7-3322

RAILS and ACCESSORIES
RELAYING RAILS—Super-quality machine-reconditioned—not ordinary Relayers.
NEW RAILS, Angle and Splice Bars, Bolts, Nuts, Spikes, Frogs, Switches, Tie Plates, and all other Track Accessories.
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PITTSBURGH NEW YORK CHICAGO

New and Guaranteed Tested Reconditioned
STEEL PIPE AND BOILER TUBES
In Light Weight, Standard or Heavy
Jos. Greenspon's Son Pipe Corp.
NAT'L STOCK YDS (ST CLAIR CO) ILL.

MOTOR GEN. SET
300 KW, 600 Volt, 900 rpm, Westinghouse to a 450 HP, 3 phase, 60 cycle, 80% P.F. Westinghouse Synchronous motor with A.C. & D.C. panels.
GEORGE SACHSENMAIER CO.
Holmesburg, Philadelphia, Pa.

NEED DUMP CARS?
IMMEDIATE DELIVERY
12, 24-yd. Koppel 24, 16-yd. Western
10, 20-yd. Koppel 10, 16-yd. Kilbourne & Jacobs
10, 20-yd. Western 62, 12-yd. Western
Illustrated specifications available
OTHER TYPES OF CARS TOO
Also Locomotives, Cranes, Shovels, Etc.
IRON & STEEL PRODUCTS, INC.
13484 S. Brainard Ave. Chicago, Illinois
"ANYTHING containing IRON or STEEL"

BUY FROM A CONCERN BOTH FINANCIALLY AND MORALLY RESPONSIBLE

LOCOMOTIVES

Goodman: All 250 volts.
1—10 ton, 31-1-4-T
1—6 ton, 30B, 48" 1—5 ton.
1—5 ton, W-1-2, 36"
Westinghouse: All 250 volt.
1—4 ton, 902, 48" 1—18-ton, 102, 42"
1—904 c. 44" 500 volt. Also 906 motors.
1—10 ton, 915
G.E.: All 250 volt, 5 ton 825, 44"
6 ton 803, 44", as is 4 ton 1022, 41, as is
6 ton 823, 44" 8 ton 839 motors.
Jeffrey: 6 ton, and 4 ton, all gauges, 250 volt.

MINING MACHINES

Jeffrey, 35B, 29B, and 4—28A 250 V. 2—29C with drop bar support.
Goodman, 12A, 12AB, 12AA, 12G3A, 124EJ.
1—12G3 250 volt and 2—112 DA, 500 volt.
2—Permissible Type 12CA.
Sullivan, CE7, CE9, CE10, CR10 Low Vein
1 Class 5 Buddy and Shearing Machine. AC and DC.

SUBSTATIONS—275 volts, D.C.

1—200 KW **West.** Converters.
2—200 KW **Ridgeway** Converters.
1—150 KW **G.E.** Rotary.
1—150 KW **West.** Rotary.
2—150 KW, 2—100 K **Ridgeway** M-G Sets.
1—150 KW **West.** M-G Sets.
1—200 KW **G.E.** Rotary Converter.

AERIAL TRAMWAYS * HOISTS * PUMPS * MOTORS * TRANSFORMERS * BOND WELDERS * RESISTANCE. COMPRESSORS * DUMP SPEED REDUCERS FIELD FRAMES * ARMATURES * GOODMAN HYDRAULIC SHOVEL * MOTOR STARTERS AND CONTROLLERS—AC & DC * DROP BAR SUPPORTS (Gooseneck), 29B and 29C * MINING MACHINE TRUCKS * SWITCHBOARDS * CIRCUIT BREAKERS—AC & DC * CONVEYOR HOISTS COAL CRUSHERS, double roll 12"x16" single roll 24"x24" and 18"x16" * Sullivan BIT SHARPENER * TURBO-GENERATOR 500 K.W. 275 volt DC * ROPE & BUTTON CONVEYOR 400' long LATHES, SHAPERS * LINK BELT * ELECTRIC SLATE DUMP * 2 SIRENS A.C. * RAILWAY SWITCHES 85# and 100#, STEAM POWER PLANT, 2 Boilers 2 turbo-generators, 2300 volt, 2 Jeffrey MH 110 Locomotives, 1 Clam shell bucket 1¾ cubic yard.

GUYAN MACHINERY COMPANY, Logan, W. Va.

For Sale

20, 5BU Loading Machines

A. C. MOTORS

30 Units, 15 to 75 H.P. squirrel cage 3/60/440

D. C. MOTORS

15 Units, 3 H.P. to 60 H.P., 230 V.
40 KW, 110 V. D.C. Generator
200 KW, 600 V. Motor Generator Set synch. motor, 3/60/2200
1000 KW Turbine Type G.E. Generator 3/60/2300, 3600 RPM
500 KW G.E. Skinner Uniflow Steam Engine Generator, 250 V. D. C.
500 KW Westinghouse Motor Generator Set
6½-yd. 320-B Bucyrus Stripping Shovel
¾-yd. P. & H. Crawler Crane, 38' boom

IRON & STEEL PRODUCTS, INC.
37 years' experience
13484 S. Brainard Ave., Chicago, Illinois
"*Anything* containing IRON or STEEL"

★ DISMANTLING MINE ★

ONE MILE FROM LOGAN—*All 250 Volt, 44" track gage*

1—150-KW **G.E. Rotary Converter outfit complete,** 6600 volt transformers.
2—**Jeffrey** MH-96 **Locomotives** complete with cable reels.
1—**G.E.** 826 **Locomotive** complete with cable reel.
1—**G.E.** 823 **Locomotive.**
2—12-AA **Goodman Cutting Machines,** 7' bars.
1—90-HP. **Thomas Elevator slope Hoist** complete.
3—37½ KVA **Transformers,** 6600 to 230-460.
3—25-KVA **Transformers** 6600 to 110-220.
4—**Myers Plunger Pumps** comp. with motors.
1—3-Stage **Dayton Dowd Centrifugal Pump** with 25-HP. A.C. motor.
1—3-track **Kanawha Tipple** with shaker screen and loading booms.
Railroad sidetrack, store and office equipment and many other items too numerous to mention.

COAL TIPPLE

1—**Kanawha Mfg. Co.** 4-track tipple complete with shaker screen, 3-loading booms, boom hoist, 42" x 50' belt conveyor, feeder and all drive motors out of service two months, excellent condition.

LET US KNOW YOUR NEEDS—WE BUY, SELL AND TRADE

ALL-STATE EQUIPMENT CO., Inc.
LOGAN, WEST VIRGINIA *Phone 884*

NEW and REBUILT
STORAGE BATTERY
LOCOMOTIVES
1½ to 10 Ton—18" to 56" Track Gauge
GREENSBURG MACHINE CO.
Greensburg, Penna.

DISMANTLING COAL MINE

(Mark Mine, Mark, Ill.)

FOR IMMEDIATE DELIVERY: 4 Jeffrey Longwall; 2 Sullivan Longwall; 3 6 ton Goodman Hauling motors; 4 track Roberts-Schaefer Tipple complete with screens and boom loaders; Litchfield steam hoist engine, 500 H.P. complete with Hoist drum and 1400 ft. 1¼ inch cable; 3 Scotch Marine 100 H.P. Boilers; 3 Erie 100 H.P. Boilers; 850 KW American Ball Generators; Pit cars; Mills deep well pump and dozens of other items all in excellent condition.

Priced to move quickly

CLONICK STEEL COMPANY
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PUMPS

Two—United Iron Works Size 8 MSD—4 Stage 3000 GPM—700 Ft. Head 10" Suction 8" Discharge—700 H.P. G.E. Motors—2300 Volt—3 Phase—60 Cycle—145 Amps.

Many Other Pumps Various Sizes and Capacities
IMMEDIATELY AVAILABLE

PLEASANTVILLE CONSTRUCTORS, INC.
CHELSEA NEW YORK

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ELECTRIC SHOVEL
6½-7½ yd. Bucyrus 320-B; Railroad Trucks
IRON & STEEL PRODUCTS, Inc.
37 years' experience
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500 Ft. Second Hand Conveyor Belt, 48 Inch, 9 Ply, 32 Oz., 3/16" Top, 1/32" Bottom Cover

ROGAN & ROGAN CO.
Middlesboro, Ky.

IRON and STEEL PIPE
New and Used
Large stocks, all sizes attractive prices
L. B. FOSTER COMPANY, Inc.
P. O. Box 1647 Pittsburgh, Pa.

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—to help you sell what you no longer need.

Take advantage of it—For Every Business Want

"Think SEARCHLIGHT First"

Desirable Electric Equipment—Prompt Shipment From Our Warehouse

SYN. MOTORS 3 ph. 60 cy.

HP	Make	V.	Speed
350	Al. Ch.	2200	600
2— 75	Westgh.	2200	900
75	Westgh.	220	1800

M-G SETS 3 ph. 60 cy. (Syn.)

150 KW West. 550 v. DC 2200 v. AC—1200 RPM
150 KW Ridgway 250 V.—2300 V. AC 900 RPM
100 KW Ridgeway 250 V.—2200/3/60 1200 RPM
100 KW Cr. Wh. 2502 DC—440/3/60 1200 RPM
100 KW G.E. 550 v. D.C. 2200/3/60 A.C. 900 RPM.
90 KW Al. Ch. 250 v. 2200 v. AC 900 RPM.

LOCOMOTIVES

4 Ton Ironton 36" Ga. Type D with 36 cells 19 plate Exide Battery.
5½ Ton Type D Ironton 36" Ga. with 48 cell 21 plate Exide Battery.
Charging M.G. Set & Panel for each loco.
5 Ton Jeffrey Storage Battery 42 to 44" Ga. 2 BB motors, Battery box on top.
6 Ton Whitcomb 50 v. 40" Ga.
8 Ton Jeffrey 250 v. 42" Ga. MH 100 Motors
10 Ton West. 250 v. 42" Ga.
12 Ton Jeffrey 250 v. 40" Ga. MH 74 Motors

MINING MACHINES

35 B Jeffrey 250 v. 36" Ga. #18972, 6' bar.
35 B Jeffrey 250 v. 36" Ga. truck 6' bar #11.416.
2—CE 7 Sullivan DC standard 30 HP
1—12 G3 Goodman Std. Truck 220/3/60 6' bar.

SLIP RING & SQ. CG. MOTORS
(3 ph. 60 cy.)

HP	Make	Speed	Wdg.	Type
700	G.E.	393	S.R.	MT 432
400	West.	500	S.C.	CS
300	G.E.	600	S.R.	IM
250	G.E.	600	S.R.	I-L
200	Cr. Wh.	440	S.R.	28
200	G.E.	600	S.R.	I-L
200	Al. Ch.	600	S.C.	
150	G.E.	600	S.R.	I-L
150	West.	580	S.C.	CCL
150	G.E.	600	S.R.	IM
125	G.E.	600	S.R.	I-L
125	Al. Ch.	435	S.R.	
125	Burke	1200	S.C.	
100	F.M.	600	S.C.	BB
100	Burke	900	S.C.	
100	G.E.	500	S.R.	MI-25 cy
75	G.E.	865	S.C.	KT

HOISTS

75 HP Lidgerwood sgl fr. drum
50 HP Diamond 2 drums same Shaft
30 HP Clyde sgl. drum AC Motor
25 HP Thomas sgl. drum AC Motor
15 HP Lidgerwood sgl. dr. AC Motor Pumps

400 TRANSFORMERS
(Westgh. & GE 1 ph.)

Qu.	KVA	Pri. V.	Sec. V
3	1	2080/2200	115/230
5	2	"	"
10	5	"	"
13	7	"	"
7	10	"	"
10	15	"	"
2	25	"	"
1	30	"	"
3	37 Rotary	4400/185	"
2	100	"	
	3 Phase		
1	150	"	230/460

ENGINE GENERATOR SETS

100 KW 250 v. DC Westgh.—Skinner Engine

AIR COMPRESSORS

550 cu. ft. 100# Bury 2 stage
2—505 cu.ft. 55# Sullivan 14 x 10
2—355 cu.ft. 100# Chg.Pn. 12 x 10
160 cu. ft. Chic. Pneu. 100#

D. C. MOTORS

1 to 125 HP, all speeds

MOORHEAD-REITMEYER CO., INC.
PITTSBURGH, PENNSYLVANIA

FOR SALE

We offer 523, 55-ton all-steel, self-clearing

DOUBLE HOPPER CARS

consisting of:

160 USRA construction; built 1921-1922; with A-B brakes; 1880 cubical feet capacity.
363 built 1910-1915; with KD-1012 brakes, 1683 feet capacity.

ALL HAVE FULL "U" CAST STEEL TRUCK FRAMES

Purchaser must buy all.

PRICE: $1700.00 each f.o.t. Pennsylvania.

TERMS: Cash with purchase.

DELIVERY CAN COMMENCE IMMEDIATELY AND BE COMPLETED IN ABOUT 60 DAYS—AND VERY POSSIBLY SOONER.

Some $30,000 to $40,000 NEW REPAIR MATERIALS also available which you may wish to have inspected at the same time.

TIME and EXPEDITION ESSENTIAL and DESIRABLE.

Yours for Victory,

IRON & STEEL PRODUCTS, INC.

37 years' experience

13484 S. Brainard Ave. **Chicago, Illinois**

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SUB STATIONS

1—300 KW G. E. Syn. M. G. Set 3/60/2300—80% PF, 275 V DC.
1—35 KW 125 V Battery Charging Set.

MINE LOCOMOTIVES

1—6 ton Jeffrey MH 88 250 V motors.
1—6 ton G. E. with 250 V motors.
2—5 ton G. E. HM 825 motors with gathering reel.

CUTTING MACHINES

8—35B Jeffrey 250 V Shortwalls.
1—35BB Jeffrey AC Shortwall.
1—12G3 Goodman AC Shortwall.
2—12AB Goodman 210 V DC Shortwall.
1—29B Jeffrey Arcwall DC.
1—29C Jeffrey Arcwall DC.
1—29LE Jeffrey with turn over head AC Motors.

MISCELLANEOUS

1—90L Goodman Elevating Conveyor.
1—Sullivan Bit Sharpener.
1—36"x36" single roll Crusher.

Tippins Machinery Co.

3530 Forbes St. Pittsburgh, Pa.

BELT CONVEYORS IN STOCK

12"-14"-16"-18"
20"-24"-30"-36"

ALSO

CONVEYOR BELTING

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FOR SALE

Locomotives—Mining Machines
Pumps—Motors—Transformers
Steel Tipples — Rescreeners
Steam Hoists—Electric Hoists
Compressors — Loading Booms
Engines — Generators — Scales
Miscellaneous Mine Equipment

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COMPLETE MINE EQUIPMENT

2 Steel Tipples, Steam Hoist, Shaker and Engine, Boilers, Engine and Generator 150 K.W. Scale, 10 ton Locomotive, Pump Mine Cars 36" gage, Rail, Wire.

P. O. Box 319 **Belleville, Illinois**

SEARCHLIGHT SECTION

FOR SALE

1—One **NORDBERG Hoist** No. 06392, 4 ft. drum, hydraulical brake direct connected, 150 h.p., GE motor AC, 440 v. 3 ph. 60 cycle, speed 585, complete with panel board and ammeter.

2—Three **GE** 50 KVA Transformers.

3—One **POMONA Vertical Pump,** 75 h.p., AC, 250 v. 60 cy. 3 ph. Westinghouse motor, together with starting compensator, capacity 1000 gal. per min., 200 feet head.

4—One **ALLIS CHALMERS Pump,** type BS 13406, 100 h.p., motor AC, 220 v. 60 cy., 3 ph., capacity 1000 gal. per min., 250 feet head.

5—One **GE MOTOFLOW** model 5 KF 404 DWL **Pump** direct connected, 40 h.p. motor AC 440-220 v., 60 cy., 3 ph., 4" suction 2" discharge, capacity 300 gal. per min., 340 feet head.

All of the above equipment in first class operating condition

FS-651, Coal Age
520 No. Michigan Ave., Chicago, Ill.

Immediate Shipment
Low Prices

NEW RUBBER

Guaranteed
High Grade

CONVEYOR and TRANSMISSION BELTING

CONVEYOR BELTING
ABRASIVE RESISTANT COVERS

Width	Ply	Top	Bottom	Covers
48"	8	1/4"		1/16"
42"	5	1/4"		1/16"
36"	6	1/4"		1/16"
30"	6	1/4"		1/16"
30"	5	1/4"		1/16"
24"	5	1/4"		1/32"
24"	4	1/4"		1/32"
20"	5	1/4"		1/32"
20"	4	1/4"		1/32"
18"	4	1/4"		1/32"
16"	4	1/4"		1/32"
14"	4	1/16"		1/32"
12"	4	1/16"		1/32"

TRANSMISSION BELTING
HEAVY-DUTY FRICTION SURFACE

Width	Ply	Width	Ply	Width	Ply
18"	6	10"	6	6"	5
16"	6	10"	5	5"	5
14"	6	8"	6	4"	5
12"	6	8"	5	4"	4
12"	5	6"	6	3"	4

ELEVATOR BELTING
HEAVY DUTY RUBBER COVERED

Width	Ply	Top	Bottom	Covers
12"	6	1/16"		1/16"
14"	6	1/16"		1/16"
16"	6	1/16"		1/16"
18"	6	1/16"		1/16"

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"A" — WIDTH — All Sizes
"B" — WIDTH — All Sizes
"C" — WIDTH — All Sizes
"D" — WIDTH — All Sizes
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Sold in Matched Sets

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SCRANTON, PA.

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1800 GPM at 235 ft. head
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1—**Chain Flight Conveyor** (Scraper 32" wide)
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1 set—**Heyl & Patterson Jouncer Screens**
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Box 448 — Imperial, Pa.

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390—**Fairmont Steel Ties** 32" track gauge.
1—36" x 28" **Mine Fan** complete.
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3—**Sullivan** Type CE-7 **Cutting Machines,** 250 Volt D.C. complete with trucks.
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1—**Standard Engineering Co. Pipe Threading Machine** complete with dies. Threading range 2"—6".
1—**Fort Wayne Electric Rock Drill,** type A with 230 volt D.C. motor.
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1—**Goodman** type 90-L **Elevating Conveyor** with 5 H.P., SK Westinghouse 230 volt D.C. motor.

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UNION TRUST BLDG.
PITTSBURGH, PA.

COAL AGE ADVERTISERS IN THIS ISSUE

An asterisk preceding manufacturer's name indicates detailed information may be found in the 1942 *COAL MINING CATALOGS.* Where † appears after a company's name the advertisement does not appear in this issue, but was in preceding issues.

*Ahlberg Bearing Co..... †
Air Reduction Sales Co..... †
Allis Co., The Louis
Insert between pp 122, 123
*Allis-Chalmers Mfg. Co..... †
*American Brattice Cloth Corp. †
*American Cable Div. of American Chain & Cable Co. ....
Third Cover
American Car & Foundry Co..44, 45
American Colloid Co..... 142
American Cyanamid & Chemical Corp. 17
*American Mine Door Co..... 148
American Optical Co..... 179
*American Pulverizer Co..... 182
*American Steel & Wire Co.42, 42a
Anaconda Wire & Cable Co... 41
Atlas Powder Co..... 37

Bemis Bro. Bag Co..... 165
*Bethlehem Steel Co.....30, 31
Bituminous Casualty Corp.... 146
*Bixby-Zimmer Engrg. Co..... 153
*Bowdil Co. 181
Broderick & Bascom Rope Co. †
*Brown-Fayro Co..... 149

Calcium Chloride Assn..... 36
Cardox Corp. 29
*Carnegie-Illinois Steel Corp... †
Cass Mfg. Co..... 171
*Central Mine Equipment Co. 144, 145
*Centrifugal & Mechanical Industries, Inc. 46
Chicago Perforating Co.... 192
*Chicago Pneumatic Tool Co... 20
*Cincinnati Mine Machinery Co. 136
Cities Service Oil Co..... 52
Clarkson Mfg. Co..... †
Coal Mining Catalogs..... 152
Coffing Hoist Co..... 156
Columbia Steel Co..... †

*Deister Concentrator Co..... 164
*Deister Machine Co..... †
DeLaval Steam Turbine Co... 148
*Deming Co. 193
Differential Steel Car Co..... 188
Dorr Co..... 187
*Duff-Norton Mfg. Co..... †
*duPont de Nemours & Co., Inc., E. I. (Fabrikoid Div.) 186
*duPont de Nemours & Co., Inc., E. I. (Explosives Div.) 183
*duPont de Nemours & Co., Inc., E. I. (Grasselli Chemicals Dept.) ..... †

Edison Storage Battery, Div. of Thos. A. Edison, Inc.... 33
*Electric Storage Battery Co... 139
Ensign-Bickford Co. 58
*Enterprise Wheel & Car Corp. †

Fairbanks Co., The..... 193
*Fairmont Machinery Co..... 178
Flexible Steel Lacing Co..... †
*Flocker & Co., John..... †
Flood City Brass & Electric Co. †
Flory Mfg. Co..... †

Gates Rubber Co..... 50
General Cable Co..... 176
*General Electric Co.....26, 27
General Electric Co. (Appliance and Merchandising Dept.)...168
190
Goodman Mfg. Co.....18, 19
Goodrich Co., B. F..... 1
Goodyear Tire & Rubber Co... †
*Gorman-Rupp Co. 192
Gould Storage Battery Corp.. †
Goyne Steam Pump Co..... 190

*Hazard Insulated Wire Works 47
*Hazard Wire Rope Div. American Chain & Cable Co.. †
Hendrick Mfg. Co..... 192
Hercules Powder Co..... †
Heyl & Patterson, Inc..... †
Holmes & Bros., Robt..... †
Hulburt Oil & Grease Co.....2, 3

I. T. E..... 177

*Jeffrey Mfg. Co.
Insert between pp. 20–25
Johnson March Corp., The... 166
*Jones & Laughlin Steel Corp.. †
*Joy Mfg. Co.....56, 57

Keystone Carbon Co., Inc.... 157
Koehler Mfg. Co..... 185

*LaBour Co., Inc..... †
*Laughlin Co., Thomas..... 154
*Leschen & Sons Rope Co., A. 147
Lima Locomotive Works, Inc. †
Lincoln Engineering Co..... 28
*Link-Belt Co.....Fourth Cover

Mack Trucks, Inc..... 8
Macmillan Petroleum Corp.... †
Macwhyte Co. 48
Marlo Co. 175
McGraw-Hill Book Co..... †
McLanahan & Stone Corp.... 192
McNally-Pittsburgh Mfg. Co. 34, 35, 161
*Merrick Scale Mfg. Co..... 170
*Metal & Thermit Corp....158, 159
*Mine Safety Appliances Co... †
*Mining Safety Device Co..... 51
Morrow Mfg. Co..... 141
Mosebach Electric & Supply Co. 175
*Mott Core Drilling Co..... †
*Myers-Whaley Co. 43

*National Malleable & Steel Castings Co. ..... †
*Norma-Hoffman Bearings Corp. 40

Ohio Brass Co.....14, 15
Osmose Wood Preserving Co. of America, Inc..... 167

*Pennsylvania Crusher Co..... 146
Philco Storage Battery Div... 4
*Pittsburgh Knife & Forge Co. 156
*Pomona Pump Co..... 194
Portable Lamp & Equipment Co. 171
Post-Glover Electric Co..... 157
*Pressed Steel Car Co., Inc... 162
Provident Life & Accident Insurance Co. 155

Roberts & Schaefer Co..... 194
*Robins Conveying Belt Co.... 163
*Rockbestos Products Corp.... 54
*Roebling's Sons Co., John A. 6, 143
Rollway Bearing Co., Inc..... †
*Ruberoid Co. 180

*Sanford-Day Iron Works Co.. 13
Schramm Mfg. Co..... 184
Scully Steel Products Co..... †
Searchlight Section 195-201
Seiberling Rubber Co..... †
Sinclair Refining Co..... 16
S K F Industries, Inc..... 189
Socony-Vacuum Oil Co..... †
Sprout, Waldron & Co..... 150
Standard Oil Co. (Indiana).. 25
Stearns-Magnetic Mfg. Co..... †
Stoody Co. 169
*Sullivan Machinery Co.....38, 39
Sun Oil Co.....Second Cover

Templeton-Kenly & Co..... 194
Texas Co..Insert between pp. 8, 13
Thermoid Rubber Div. of Thermoid Co. 53
Tide Water Associated Oil Co. †
Timber Engineering Co..... 160
*Timken Roller Bearing Co... 42b

U. S. Rubber Corp..... †
*U. S. Steel Subsidiaries...42, 42a

Walter Motor Truck Co..... 32
Westinghouse Air Brake Co., Ind. Div. 49
*Westinghouse Electric & Mfg. Co. 55
*West Virginia Rail Co..... 161
*Wickwire Spencer Steel Co.. 191
Wilmot Engineering Co..... 175
Wood Shovel & Tool Co..... †
*Wyckoff & Son Co., A..... 202

■

Professional Services 172

■

SEARCHLIGHT SECTION
(Classified Advertising)

BUSINESS OPPORTUNITIES 195
CORE DRILLING 195
Hoffman Bros. Drilling Co.....195
Pennsylvania Drilling Co.....195
EMPLOYMENT 195
USED AND SURPLUS EQUIPMENT 195-201
All State Equipment Co., Inc.....198
Baton Coal Company.....201
Benney Equipment Co., R. H.....196
Bradford Supply Co., Inc.....196
Briggs & Turvias, Inc.....201
Brown-Fayo Co. 201
Carlyle Rubber Co., Inc.....200
Cincinnati Machinery & Supply Co.200
Clonick Steel Co.....198
Coal Mine Equipment Sales Co....196
Duquesne Electric Mfg. Co.....197
Electric Equipment Co.....196
Electric Service Co., Inc.....195
Erman Howell & Co., Inc.....196
Foster Co., L. B.....197-198
Frank, M. K.....197
Greensburg Machine Co.....198
Greenspon's Son Pipe Corp., Jos..197
Guyan Machinery Co.....198
Hair Equipment Co.....199
Hudson Coal Co.....195-201
Industrial Equipment Corp.....197
Iron & Steel Products, Inc. 197-198-199
Jones Mining Equipment Co.....197
Kirk Co., Inc., Wallace E.....197
Moorhead Reitmeyer Co.....199-200
Pleasantville Constr. Inc.....198
Rogan & Rogan Co.....198
Sachsenmaier Co., Geo.....197
Sherwood, E. C.....197
Stanhope, Russell.....195
Swabb Equipment Co., Frank.....196
Teuscher Pulley & Belting Co.....199
Tidewater Equipment & Machy Corp. 196
Tippins Machinery Co.....199

WOOD PIPE for Mine Drainage

Wyckoff Wood Pipe has an 87 year record of perfect resistance to the corrosive action of sulphurous mine water. It is an ideal, long-time investment—light, easy to lay, and relatively low in first cost

We also manufacture a special Hard Maple Pipe for flushing culm in the Anthracite Region and wood covering for underground steam lines.

Established
1855

A. WYCKOFF & SON CO.
Office and Factory
No. 35 Home Street, Elmira, N. Y.
The Originators of Machine Made Wood Pipe

AMERICAN CABLE TRU-LAY *Preformed*

HELPS PREVENT ACCIDENTS

60% of industrial safety directors recognize that wire rope can be dangerous for workmen. A great many of them recognize that preformed wire rope is much the safer type.

● Perhaps you can't altogether correct lost-time due to illness—but you can do much to prevent accidents. Take wire rope for instance—many operators have never had a lost-time accident due to punctured hands and subsequent blood-poisoning. But many have—and in these days of emergency demands, any such accident is too many.

American Cable **TRU-LAY PREFORMED** is the safest possible rope to use. Worn or broken crown wires lie flat and in place. No wicked barbs to tear hands. **TRU-LAY** resists kinking and whipping, too—thereby handling easier, faster, safer. And acknowledgedly—it lasts longer than non-preformed.

Specify American Cable **TRU-LAY PREFORMED**—the safer rope. All American Cable ropes identified by the Emerald Strand are made of Improved Plow Steel.

AMERICAN CABLE DIVISION
Wilkes-Barre, Pa., Atlanta, Chicago, Detroit, Denver, Los Angeles, New York, Philadelphia, Pittsburgh, Houston, San Francisco, Tacoma

AMERICAN CHAIN & CABLE COMPANY, Inc. BRIDGEPORT, CONNECTICUT

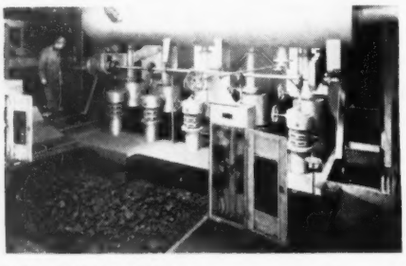
ESSENTIAL PRODUCTS . . . AMERICAN CABLE Wire Rope, TRU-STOP Emergency Brakes, TRU-LAY Control Cables, AMERICAN Chain, WEED Tire Chains, ACCO Malleable Iron Castings, CAMPBELL Cutting Machines, FORD Hoists and Trolleys, HAZARD Wire Rope, Yacht Rigging, Aircraft Control Cables, MANLEY Auto Service Equipment, OWEN Springs, PAGE Fence, Shaped Wire, Welding Wire, READING-PRATT & CADY Valves, READING Electric Steel Castings, WRIGHT Hoists, Cranes, Presses . . . *In Business for Your Safety*

Victory POINTERS ON THE OPERATION AND MAINTENANCE OF YOUR LINK-BELT EQUIPMENT

THE suggestions that follow are based on long experience and are given out, in the knowledge that they can be of definite value, both in your equipment conservation and greater production efforts. To save equipment from overloads and shocks that cause breakdowns, it is advisable to operate as continuously and uniformly as possible throughout shifts and not in intermittent spurts, at speeds much higher than rated capacities. Frequent and thorough inspection and lubrication will detect potential failures and with prompt attention to small repairs, major replacements will be averted.

SHAKING SCREENS

Tight connections with minimum "play" in reciprocating parts are essential to long life. Frequent inspection, ample lubrication required. Keep all bolts tight. Proper adjustment of bushings in connecting rods may prevent a serious breakdown. Spare drive shaft, eccentrics, and connecting rods are good insurance against delays if these vital parts fail.



WASHING UNITS

Inspect frequently. Remove accumulation of "tramp" iron that might damage refuse elevators and replace worn buckets and chain parts promptly.

Obviously, delivery of repair parts is much slower than in normal times due to material shortages. Our stocks are therefore much smaller, and we suggest that you check your equipment now and place orders for parts likely to require early replacement as far in advance as possible.

LINK-BELT

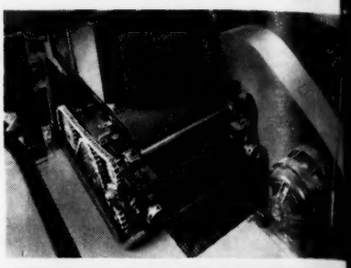
THE SYMBOL OF QUALITY

LINK-BELT COMPANY

Chicago, Philadelphia, Pittsburgh, Wilkes-Barre, Huntington, W. Va., Denver, Kansas City, Mo., Cleveland, Indianapolis, Detroit, St. Louis, Seattle, Toronto, Vancouver

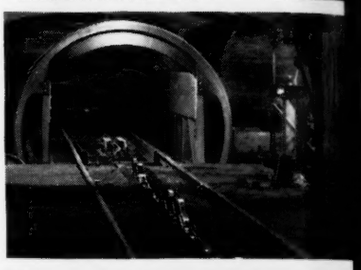
SIZER-CRUSHERS

Worn and misaligned rolls not only produce excessive oversize but put heavy strain on the entire machine. New rolls or new segments will give a more uniformly-sized product and also protect machine against possible damage.



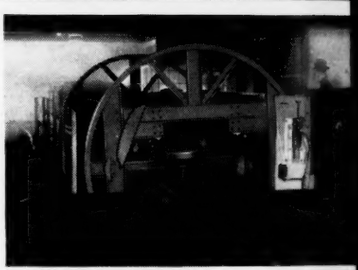
CAR FEEDERS AND HAULS

Wear, in chain links and pins increases chain pitch and may lead to broken sprockets. Loose bearing bolts may lead to broken gears. Worn brakes (on car hauls) may allow trip to get out of control and wreck cars and equipment.



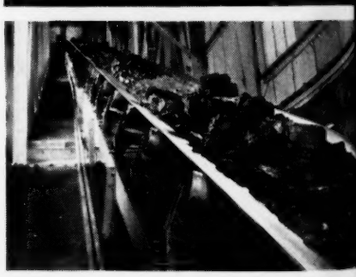
ROTARY CAR DUMPERS

Cleanup regularly and frequently. An accumulation of dirt on rings and rollers will cause excessive wear in these moving parts, as well as bearings. Worn brakes and cars badly out of shape may wreck the dumper.



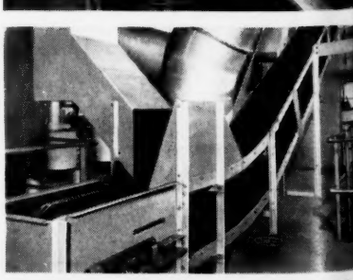
BELT CONVEYORS

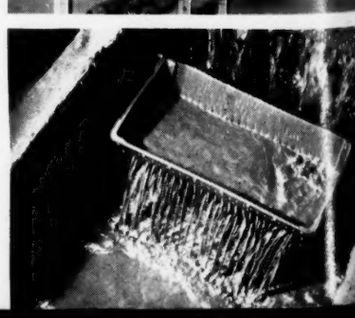
Belts under improper tension or not tracking correctly will wear rapidly. Idlers should be accurately lined up and the right amount of counterweight provided for maximum life and efficiency of belts, idlers and driving equipment.



FLIGHT CONVEYORS

Bent flights may pull chains out of line and off sprockets, wrecking conveyor. It's easier to replace a few pins, bushings, links, or flights than to rebuild a wrecked machine. Proper tension in chains (not too loose or too tight) prevents many breakdowns.



ELEVATORS

Check wear on chains (see car hauls). Bent buckets may pull chains out of line and off sprockets, wrecking elevator. As with conveyors, it's easier to replace a few pins, bushings, links, or buckets than to rebuild a wrecked machine.